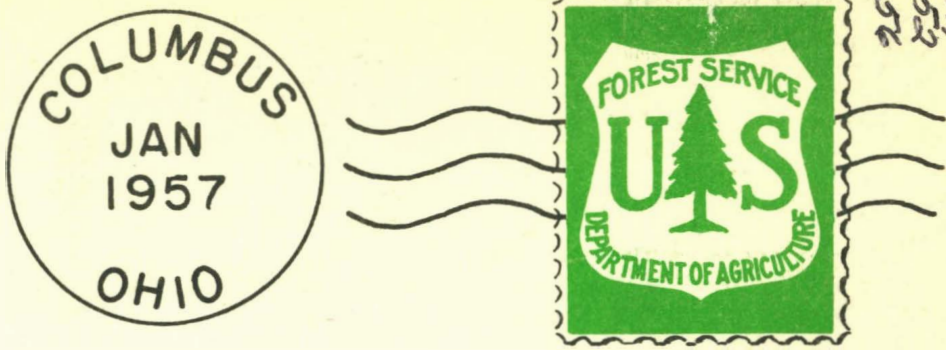
CENTRAL STATES
FOREST EXPERIMENT STATION
U. S. DEPT. OF AGRICULTURE
FOREST SERVICE



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NORMAN'S INFORMIN' AGAIN

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1956 Annual Report

Central States Forest Experiment Station, U. S. Dept. of Agriculture
Forest Service, 111 Old Federal Building, Columbus 15, Ohio
W. G. McGinnies, Director

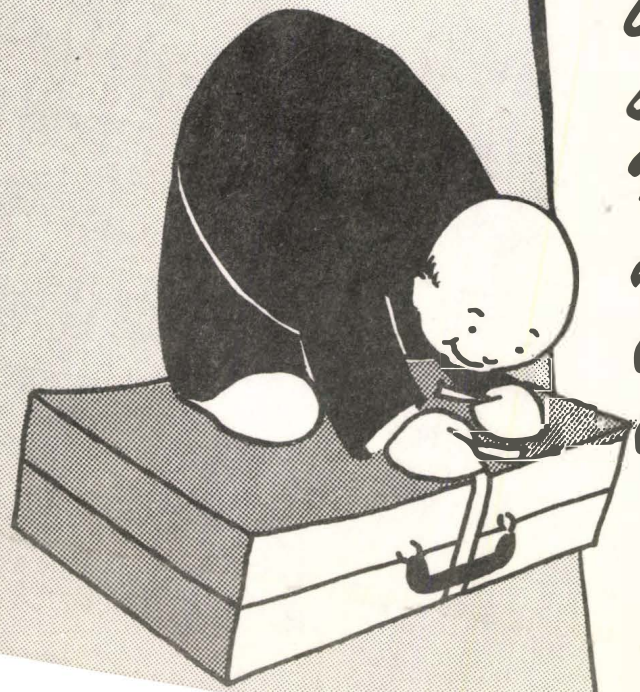
Remember Me?

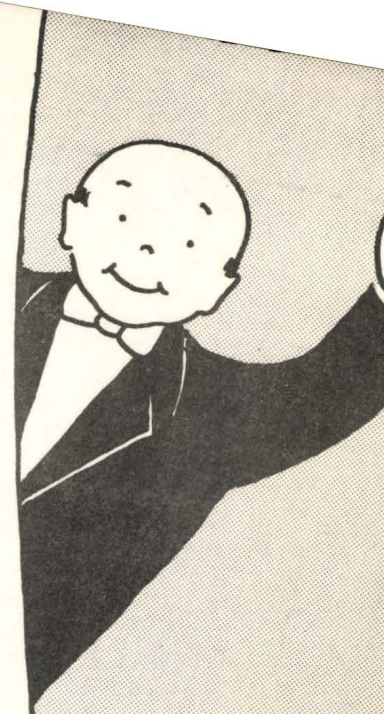
I'm Informin' Norman. I work for the Central States Forest Experiment Station.

This year I'm inviting you to take a field trip with me to our Research Centers and Experimental Forests, so you can see some of our work on the ground. I know you're busy so we'll make our visits brief. Better bring your field clothes—we'll be getting out into the brush.

Sincerely,

Norman



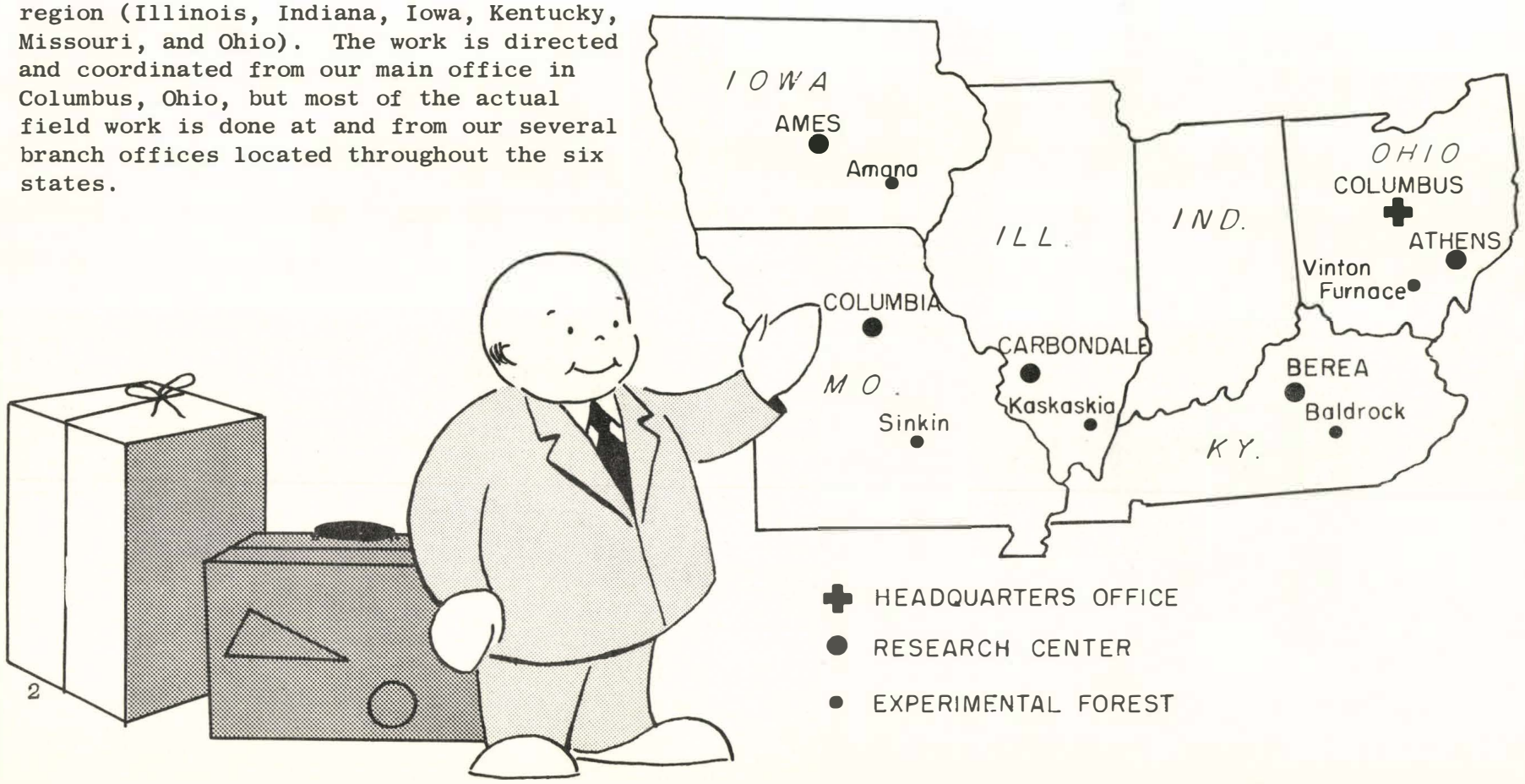


Glad you could make it!

Before we leave let's just take a minute or two to get ourselves oriented.

The Central States Forest Experiment Station is part of the Forest Service, U. S. Department of Agriculture. The Station conducts research in all phases of forestry in the Central Hardwoods region (Illinois, Indiana, Iowa, Kentucky, Missouri, and Ohio). The work is directed and coordinated from our main office in Columbus, Ohio, but most of the actual field work is done at and from our several branch offices located throughout the six states.

Our research program includes work in such varied fields as forest management, silviculture, planting, watershed management, diseases, insects, fire, grazing, resource analysis, marketing, and utilization. Forest management research (in the broadest interpretation of the term) is carried on at all our centers. Work in the other fields is concentrated where the need is greatest.



Our Forests In A Nutshell

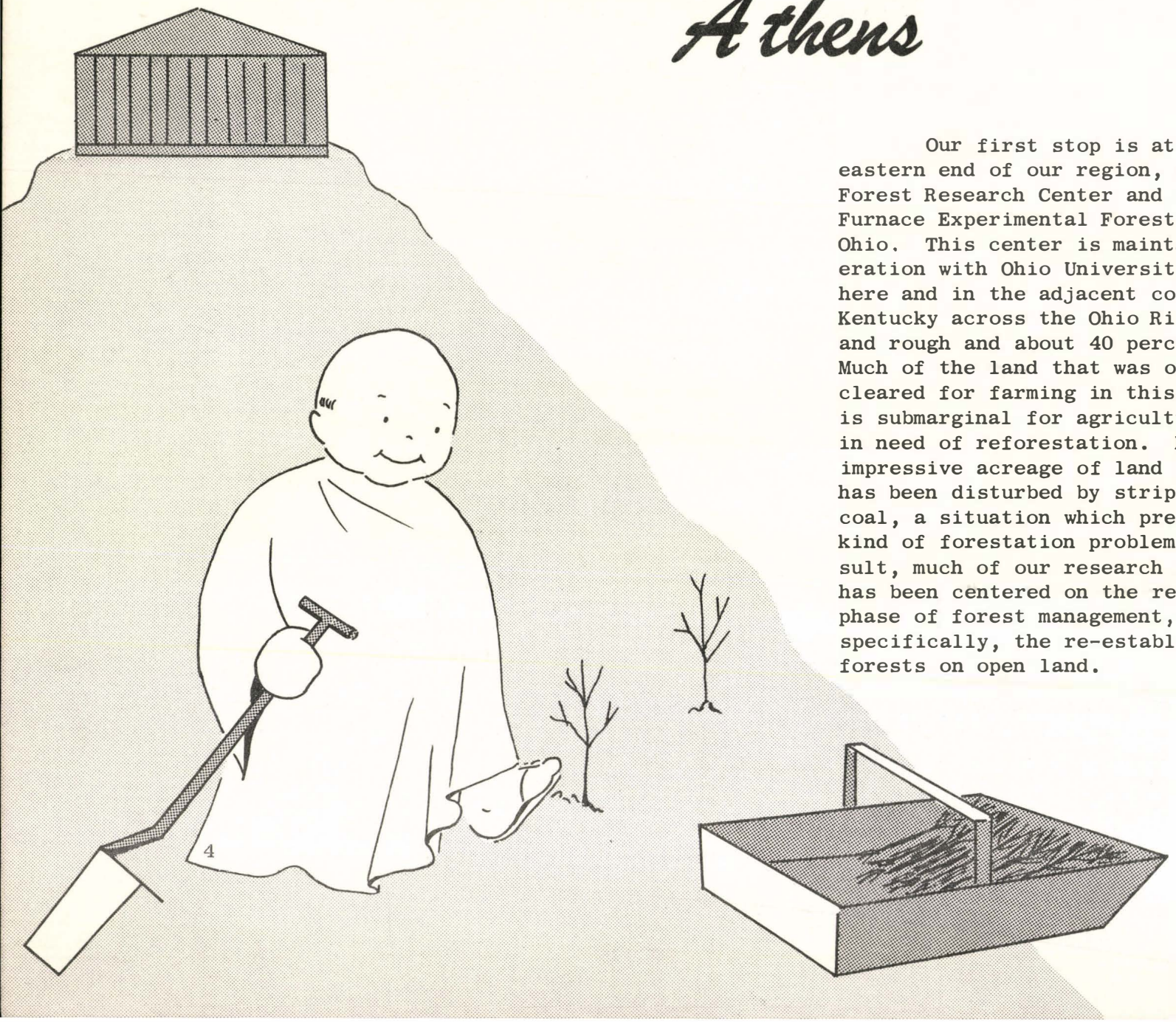
The Central States region -- in spite of being highly industrialized, densely populated, and extensively farmed -- is 20 percent forested. The forests are predominately hardwood, chiefly oak. Most of the forest land is located in the southern part of the region -- along the Ohio River, in the mountains of eastern Kentucky, and in the Missouri Ozarks.

Generally, these forests are in poor condition: understocked and containing many cull or worthless trees. The potential for producing more and better timber is there, however. In fact, the average acre of forest land in the region is considered capable of producing three times as much usable wood per year as it is producing now.

The better timber is scattered in patches throughout the northern part of the region. This is farming country and many of these small woodlands are owned by farmers who do not depend upon timber as a primary source of income. Such an ownership pattern complicates the job of increasing the productivity of the woodlands because the responsibility for managing the land is spread among so many different owners who have so many different interests.

You'll get a closer look at some of these conditions and problems as we travel from place to place. So, if you're ready, let's get started!

Athens



Our first stop is at the extreme eastern end of our region, at the Athens Forest Research Center and associated Vinton Furnace Experimental Forest in southeastern Ohio. This center is maintained in cooperation with Ohio University. The land here and in the adjacent counties in Kentucky across the Ohio River is hilly and rough and about 40 percent forested. Much of the land that was originally cleared for farming in this hill country is submarginal for agriculture and hence in need of reforestation. Moreover, an impressive acreage of land in this region has been disturbed by strip-mining for coal, a situation which presents a unique kind of forestation problem. As a result, much of our research in this area has been centered on the regeneration phase of forest management, or, more specifically, the re-establishment of forests on open land.

In an effort to overcome this problem, we tried clear cutting some of the young stands, hoping that the fast-growing sprouts that followed would resist the insect attacks.

Unfortunately, even the fastest growing sprouts were attacked by the borer. The only hopeful note is that preliminary tests of systemic insecticides that can be added to the soil like fertilizer have given some indication of success. These tests are being carried on at the Station's insect laboratory near Columbus, which we will visit toward the end of our trip.

Another phase of work that we have emphasized at the Athens Center has to do with site quality, or the ability of the land to produce trees.

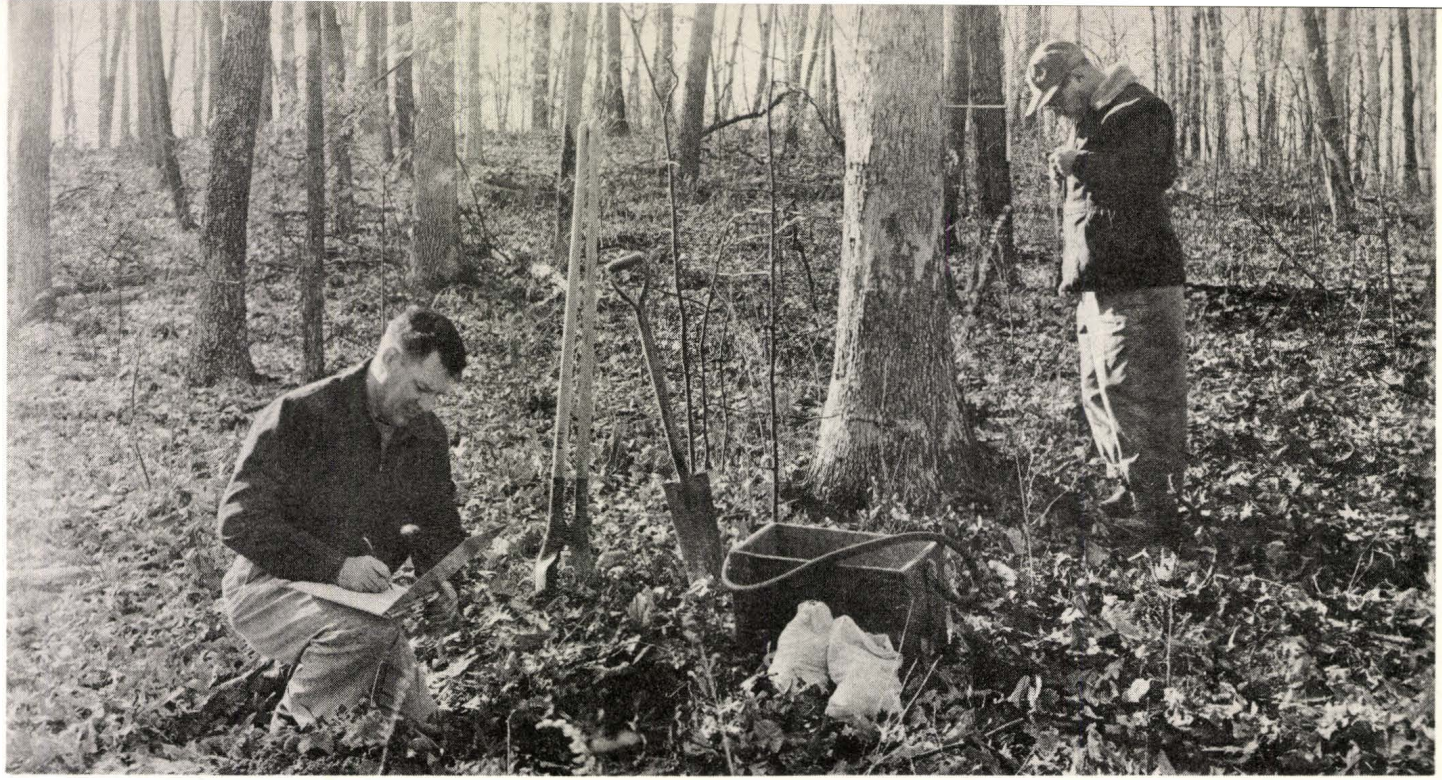
As part of these studies, we have been trying to find out what relationship exists between tree growth and soil and topographic conditions. In general we found that the most productive forest land has a deep surface soil (6 inches or more) and a well-aerated loam or sandy loam soil profile. Good sites having these soil conditions are usually found on lower slopes and coves with a north or east aspect. So far we have collected and analyzed information for white oak, yellow-poplar, black locust, black walnut, and red and white pine.

We have also been studying the ground vegetation that is found growing in the understory of forest stands. We believe that it may be possible to identify site quality and site-quality changes by the presence or absence of a few easily recognized herbaceous or woody plants.

We have recently completed a review of our spoil-bank forestation research begun in 1945. The results and conclusions will be published soon. We tried planting various species, both hardwoods and softwoods, on spoil banks. In general, black locust, cottonwood, hybrid poplars, ash, sycamore, Osage-orange, silver maple, and white, red, shortleaf, jack, and pitch pine survived and grew well. Basswood and the oaks did not survive well and yellow-poplar survival was low on acid banks. Most species survived well on calcareous banks but height growth was better on acid banks. Height growth for most species, such as this red oak, averaged about one foot per year.

Black locust served very well as a nurse crop for other hardwoods. However, it now appears that its beneficial effect is lost after about 5 years, that is, when it completely overtops the other species. So we recommend a release cut before this occurs.

Because of its adaptability to the site conditions on spoil banks, black locust has been planted pure on many of these banks. Trouble is, this species is very susceptible to attacks by the locust borer, which often destroys the trees before they reach merchantable size.



Because of the increasingly critical water situation in some parts of the Central States, a Division of Watershed Management Research was established at the Station this year. Our work in this field, however, has been going on for some time. One of our objectives is to find out what makes up the best "watershed forest," which means of course the forest cover that would protect the watershed from erosion and rapid runoff while using only a minimum amount of the soil water.

So far we have used runoff troughs to show that less surface-water runoff occurs from even-aged undisturbed oak forest than from clear-cut oak forest. The greatest amount of runoff was obtained from abandoned land covered with broomsedge and poverty grass. Periodic soil moisture measurements of undisturbed, even-aged oak and pine forest, broomsedge grass, low brush, and clear-cut oak and pine forest have shown that undisturbed forest transpires more soil moisture than does grass, brush, or sprout growth on clear-cut forest land.

Berea

About 225 miles to the south and west of our Athens Center is our newest full-fledged research center. This one is headquartered at Berea, Kentucky and is maintained in cooperation with Berea College and the Kentucky Agricultural Experiment Station, University of Kentucky.

Research at this Center will cover the vast forest resource of eastern Kentucky and will be concentrated on the Baldrock Experimental Forest. This is rugged, mountainous country, presenting not only problems in growing trees but also problems in harvesting them.

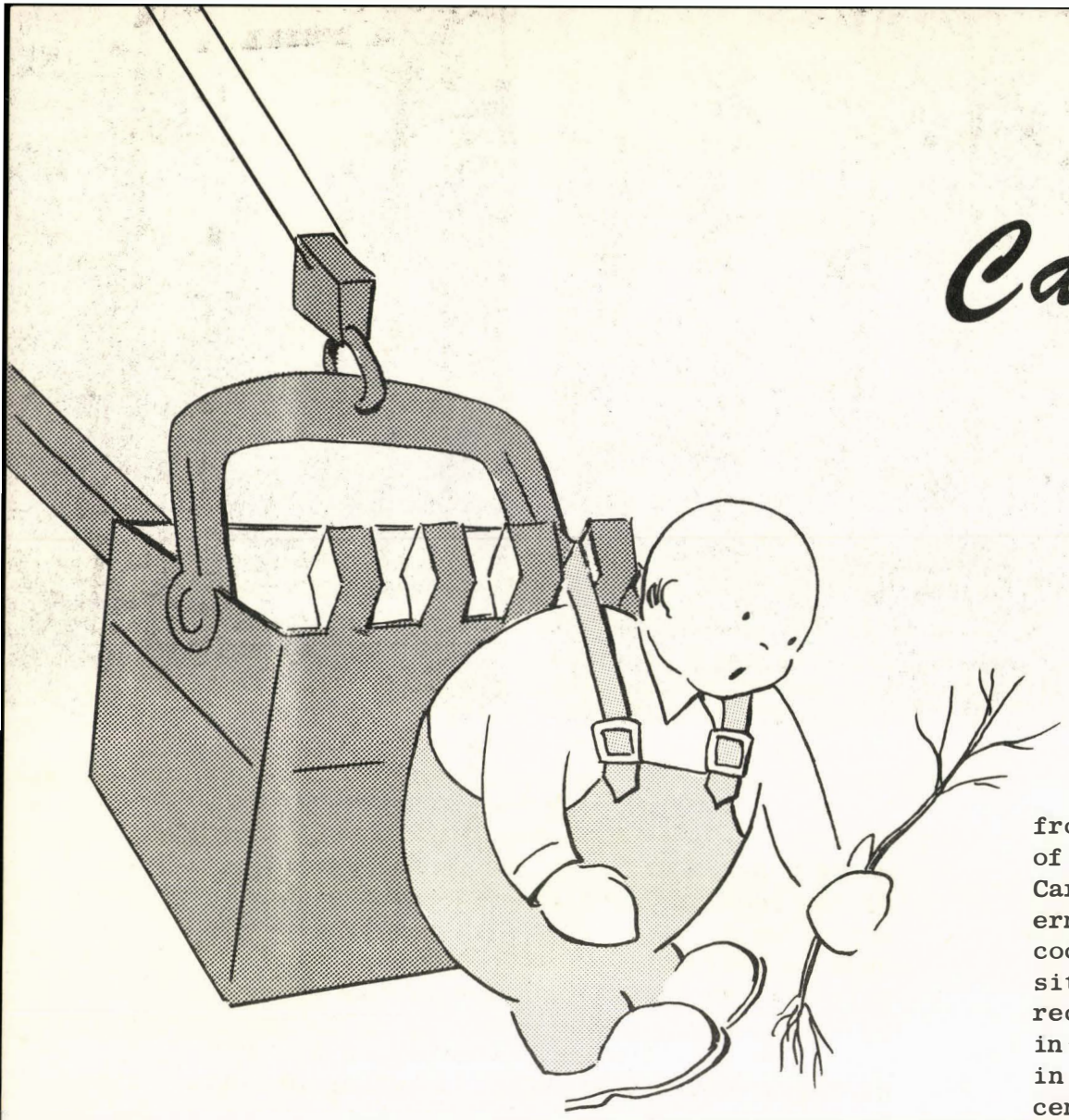
Our work during these first 2 years of the Center's existence has consisted mostly of getting acquainted with the area, its people, and its problems. However, we have begun several experiments that we feel will help to answer some of the region's more pressing forestry problems.

One study has to do with regeneration in the oak-pine forests. This type is commonly found on ridgetops. On such sites shortleaf pine is the preferred species but hardwood reproduction usually crowds out the pine seedlings (as you can see on the left) thereby limiting the quantity of pine timber produced. Our study involves testing two easy ground treatments intended to destroy hardwood reproduction and create favorable conditions for pine reproduction. One of these treatments (shown on the right) is done with a bulldozer. We are also studying the reproducing habits and abilities of shortleaf pine on these sites.

In another study being carried on in cooperation with the Kentucky Agricultural Experiment Station, we are concentrating on the hardwoods and trying to find out how to get good hardwood reproduction started in stands of low-quality trees and undesirable species.

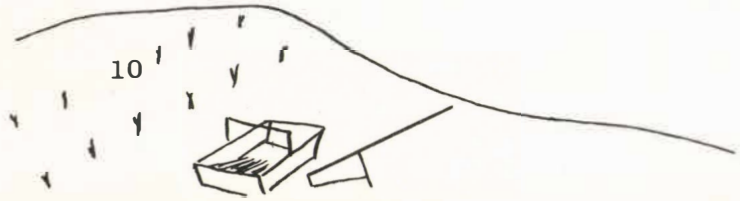
A farm woodland management study was started in cooperation with Berea College. Our aim is to develop and demonstrate an easily applied system of small woodland management. The first job is to get rid of the poor trees to give the good ones more room to grow. Our first cuttings seem to indicate that this low-quality material can be removed at a profit.

We are also well underway in a study of damage done to hardwood timber by insects. As we learn more about the life histories and behavior of the insects involved we will then begin looking for practical means of control.



Carbondale

Traveling west and a little north from Berea we come to our largest and one of our oldest research centers. The Carbondale Center is located in the southern part of Illinois and is maintained in cooperation with Southern Illinois University. Our research program here has recently been expanded to include work in forest utilization as well as more work in management. The utilization work is centered at the new Wood Products Pilot Plant operated in conjunction with the University.



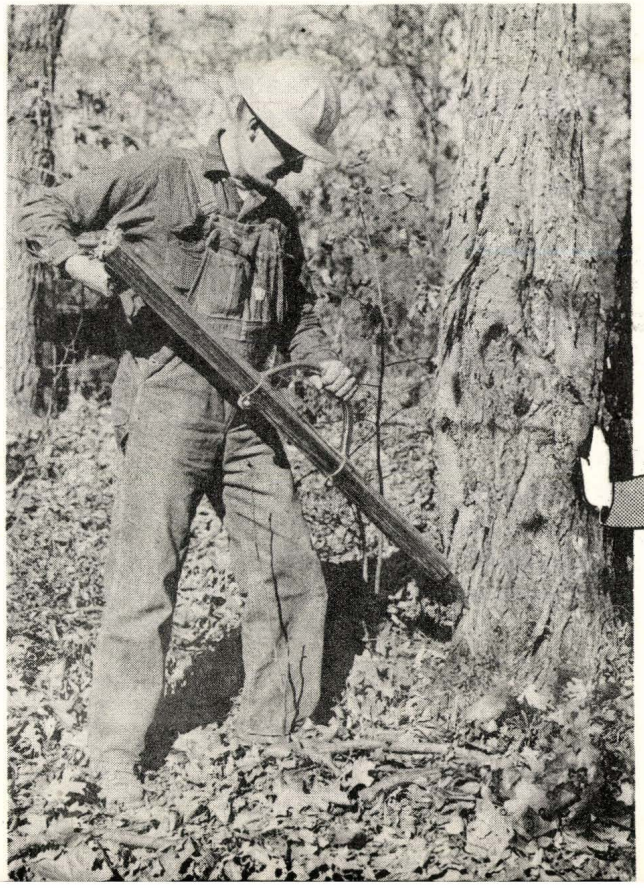
Much of our work in this area has to do with regeneration -- getting new crops of timber started. We are interested both in perpetuating established forests and starting new ones on land that is more suitable for growing trees than for any other use. We have tested many different species, both softwood and hardwood, on many different sites, including spoil banks, old fields, and cutover forest land.

Because strip mining for coal is an important industry in this section of the country, we have been concerned with the problem of reforesting strip-mined land. Some species have been found to do better on spoil banks that have been leveled off before planting and some do better if planted on the banks "as is." For example, all conifers survived better on unleveled banks, but most hardwoods survived better on leveled ones. Paradoxically, however, the reverse was true as far as height growth is concerned: conifers grew faster on leveled banks and hardwoods grew better on unleveled.

A milestone was reached this past year when we cut the last compartment in a comprehensive forest management study on the Kaskaskia Experimental Forest. A total of 750 acres has now been cut in two forest types: mixed hardwoods and oak-hickory. Fifteen different treatments were used. These stands will be valuable not only for research purposes but also as large-scale demonstrations of the several management systems.

Because so much of the present timber in the Central States is cull, one of our biggest problems is getting rid of the worthless trees to make room for younger, better ones. Trees too far gone to yield any usable wood products should be killed. The question is: how can this be done quickly, effectively, and economically? We have been working on this problem at several of our research centers but let's just look at one of the most recently installed experiments here on the Kaskaskia.

As you can see, we are testing three different methods for killing cull trees: deep notch girdling with an ax, power girdling by machine, and poisoning by means of a mechanical herbicide injector. We started out 3 years ago with ax girdling. So far we have examined 3,900 of the ax-girdled trees and found that 64 percent of them had dead tops and had no live sprouts. About 90 percent of the remaining trees had dead tops but produced some sprouts. This sprouting occurred mostly on the younger, pole-sized trees.



Another broad field of study that we have given a lot of attention to is the silvicultural treatment of forest stands. We want to find out how to treat each forest type and condition that we have in our region so as to produce the most of the best timber in the shortest possible time.

For example, in a stand of mixed bottomland hardwoods we recently cut half the merchantable volume and killed all the cull trees without reducing the actual net growth per acre. In other words, in the cut stand the new growth was put on the remaining trees -- the good ones -- while in a similar, uncut stand much of the growth was wasted on low-quality trees. Thus, a judicious improvement cut in this bottomland forest not only paid off in products currently harvested, but it also paved the way for future harvests of better products without sacrificing volume growth.

In another experiment we wanted to find out how residual, pole-sized white oaks responded when the large overstory trees were removed. Two years after these trees were released their growth rate had increased, regardless of crown class or past vigor. Such uniform response to release means that future crop trees can be selected chiefly on the basis of quality, form, and location of individual trees rather than on the basis of crown class or past growth rate.

Our work in wood utilization begins in the woods. We are just now completing the first phase of a study designed to find a practical method for predicting the value of factory-grade lumber that can be produced from a given tree. Data collected from 10 commercial operations and an independent field check show that the grade of the butt log may be a good indicator of tree value. For example, we found that an average, 20-inch, 2-log black oak with a Grade 1 butt log can be expected to yield about $24.00 worth of rough, air-dry, factory-grade lumber. By contrast, another tree of the same size and species, but with a Grade 3 butt log, will yield only about $18.00 worth of factory-grade lumber.

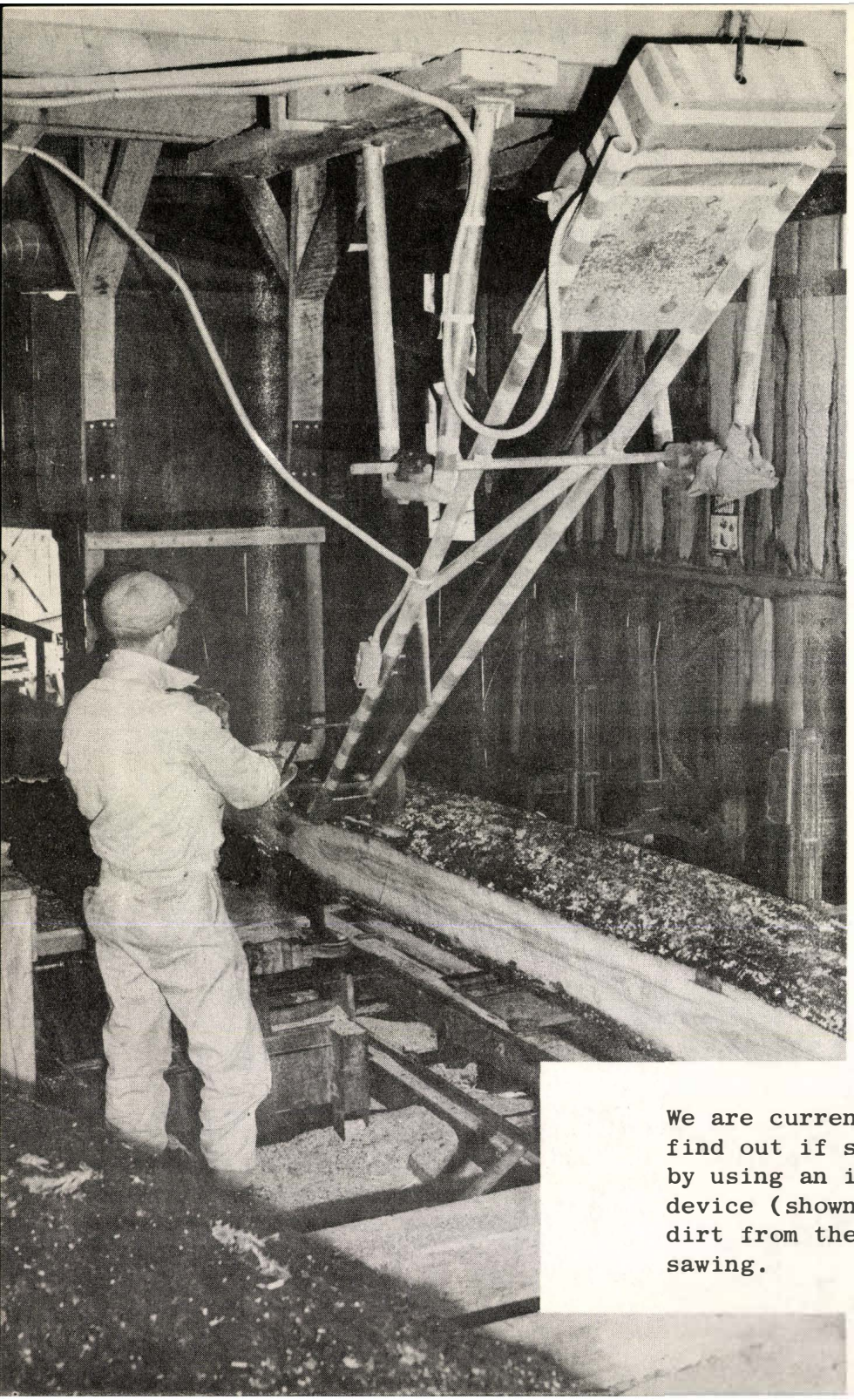
A study recently completed in southern Illinois showed that better bucking alone could have more than doubled the profit of 10 sawmilling operations.

Of course, a reduction in production costs would also make many currently cull trees merchantable.

The man you see here is helping conduct a study to determine (a) the most efficient crew size for felling and bucking hardwoods with gasoline-powered chain saws, (b) comparative performance of direct-drive and indirect-drive chain saws, and (c) the effect of tree size, wood density, and topography upon felling and bucking costs.

We also have developed information on the tractive effort required to skid hardwood logs. We have found that (a) the tractive force required to ground- or sulky-skid log loads varies directly with slope and weight, (b) the size and number of logs making up a load of a given weight have no significant effect upon resistance to skidding, (c) on level terrain sulky skidding requires less tractive effort than ground skidding for all loads weighing in excess of 500 pounds, and (d) the advantage of sulky skidding increases with slope for downhill hauls but decreases for uphill hauls.

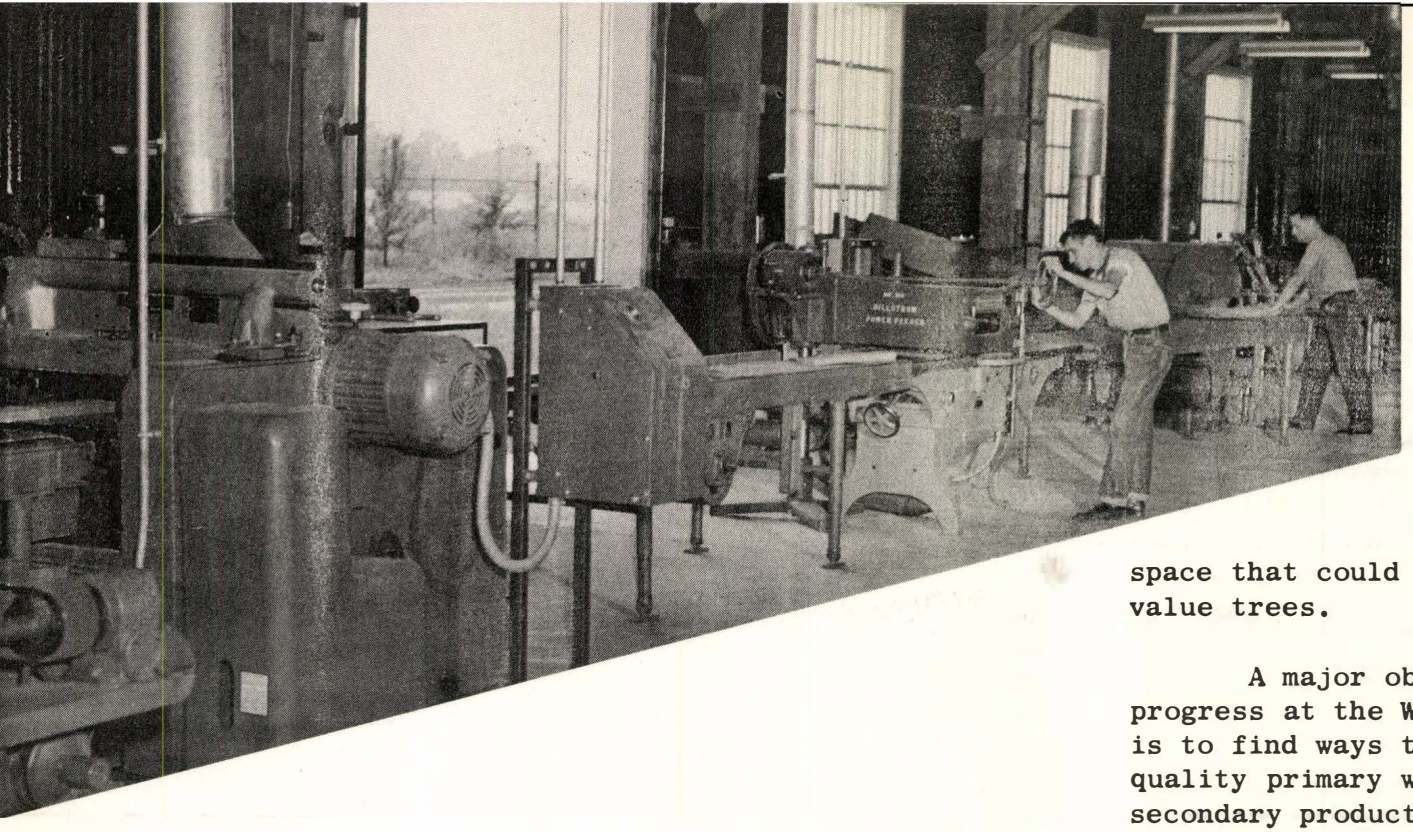
We have developed methods for determining the most efficient size of load when skidding logs with crawler-type tractors and various skidding attachments over a variety of topographic conditions. We have found that (a) the time required to travel from the log deck to the bunching point in the woods is not influenced by size of tractor or by skidding attachments; (b) the time required to bunch a given volume of logs is affected by tractor size, attachments, and bunching distance, and varies inversely with log size; (c) when ground skidding, haul time per 100 feet of distance is much less over a prepared skidroad than over an unprepared trail; and (d) when a prime mover is either overloaded or underloaded, production rate drops rapidly. This tractor is efficiently loaded for a skid run over level terrain. A smaller load would result in increased logging costs.



We are currently initiating a study to find out if sawing costs can be reduced by using an inexpensive mechanical routing device (shown here) to remove bark and dirt from the path of the headsaw during sawing.

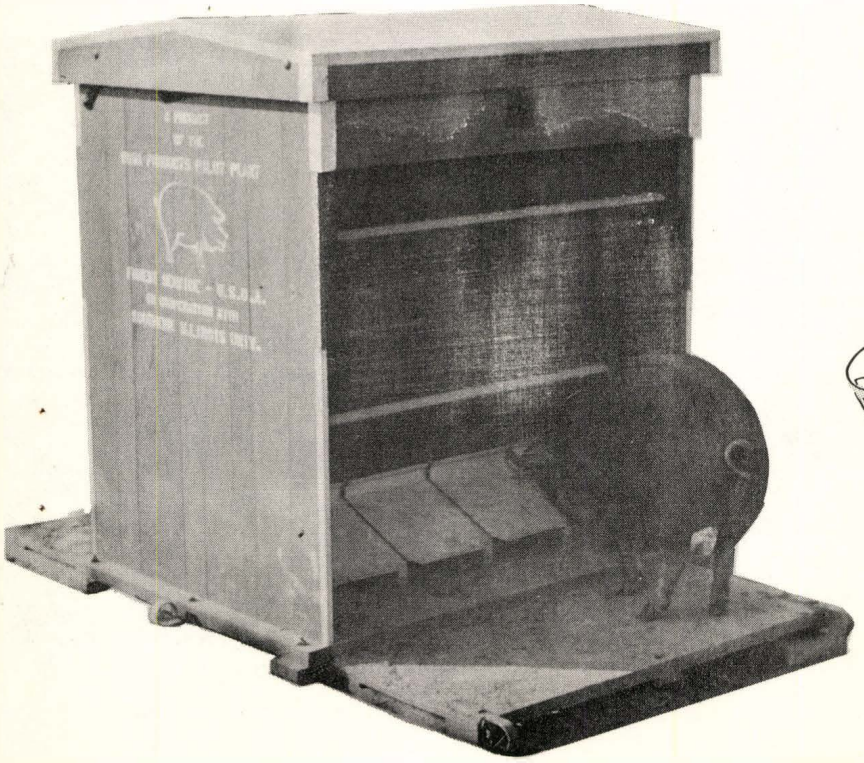
Top-quality factory-grade lumber (Firsts) sells for 4 to 6 times as much as the poorest quality (No. 3B). Consequently, a mill operator's success depends largely upon his ability to recover all of the top-quality lumber his logs will produce. Past studies and general observations indicate that this ability varies widely among sawyers, but that sawing procedures could be developed that would result in better grade recovery at almost any mill. We are currently cooperating with the Forest Products Laboratory in a study designed to develop such procedures.

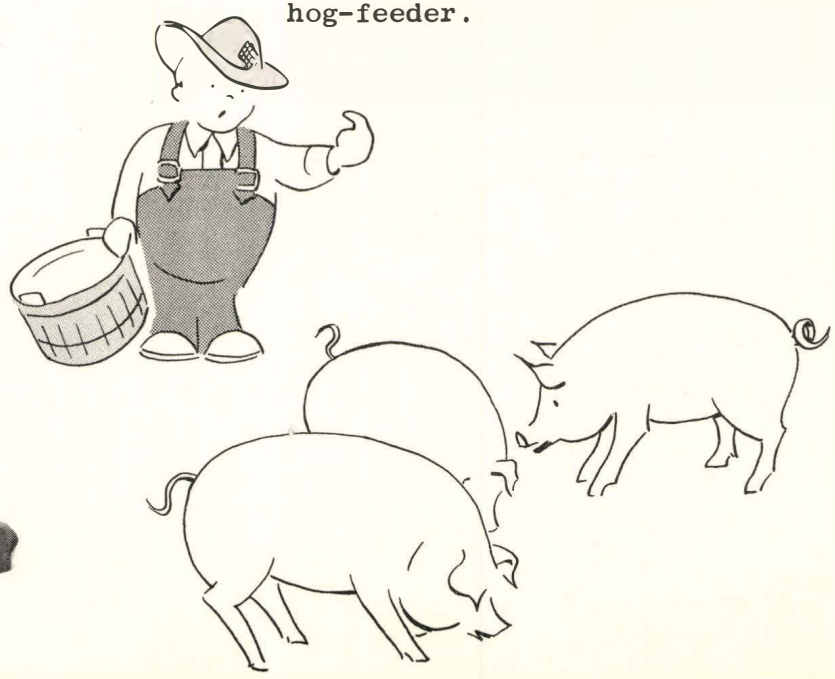
Milling costs usually account for about one-quarter of the total cost of producing rough, air-dry lumber. An important factor contributing to this high cost is "down time." A small mill that is in actual production more than 6 hours out of an 8-hour day is generally considered to be more efficient than the average. A good portion of the nonproductive hours at most small mills -- especially those sawing ground-skidded logs -- is traceable to headsaw maintenance.



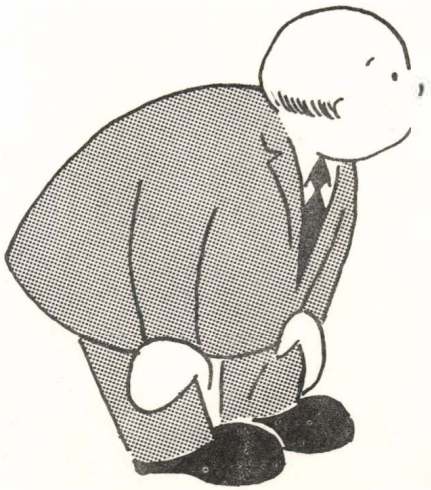
More than three-fourths of our sawtimber volume is in low-quality trees. Because many of these trees are considered to be unmerchantable, they are seldom cut -- therefore they continue, year after year, to occupy space that could support thriftier, higher value trees.

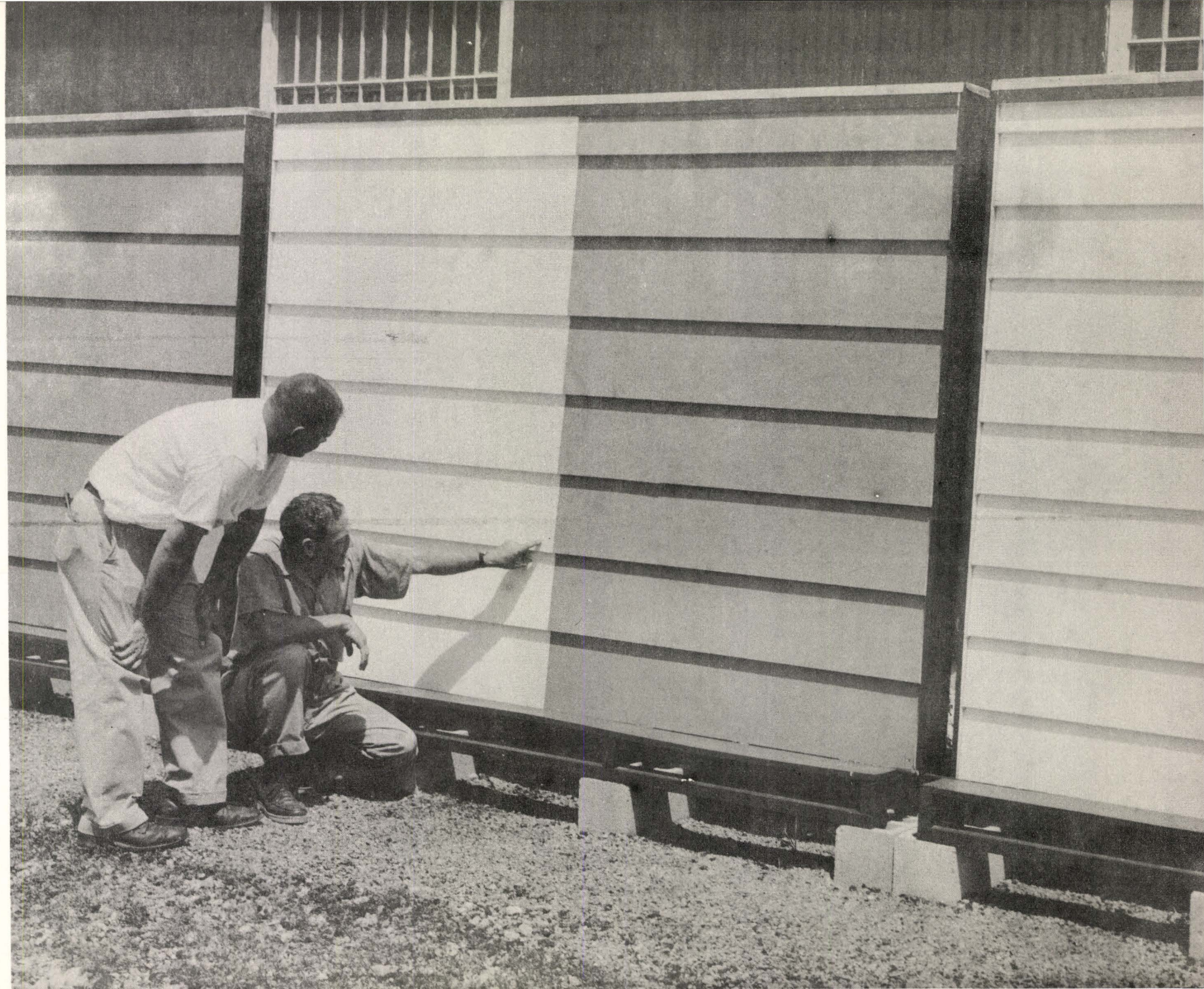
A major objective of research now in progress at the Wood Products Pilot Plant is to find ways to profitably convert low-quality primary wood products to salable secondary products. One of our projects is designed to determine the feasibility of producing various small farm structures from hardwood lumber, such as this portable hog-feeder.





Another means of utilizing low-quality hardwood lumber has been demonstrated at the Wood Products Pilot Plant during the past year. Paper-overlaid oak, hickory, and cottonwood lumber have been used as exterior house siding on five panels to demonstrate one promising use for this material. The overlaid lumber used in these panels was prepared at the Forest Products Laboratory in cooperation with the Central States and Southeastern Forest Experiment Stations. It consists of a low-quality lumber core overlaid on both wide faces with a sheet of resin-impregnated paper. The paper serves to mask the defects in the core and also improves such characteristics as dimensional stability, resistance to warping and weathering, and paintability. The paper-overlaid material shows considerable promise for use as house siding, paneling, shelving, cabinet partitions, and similar products.



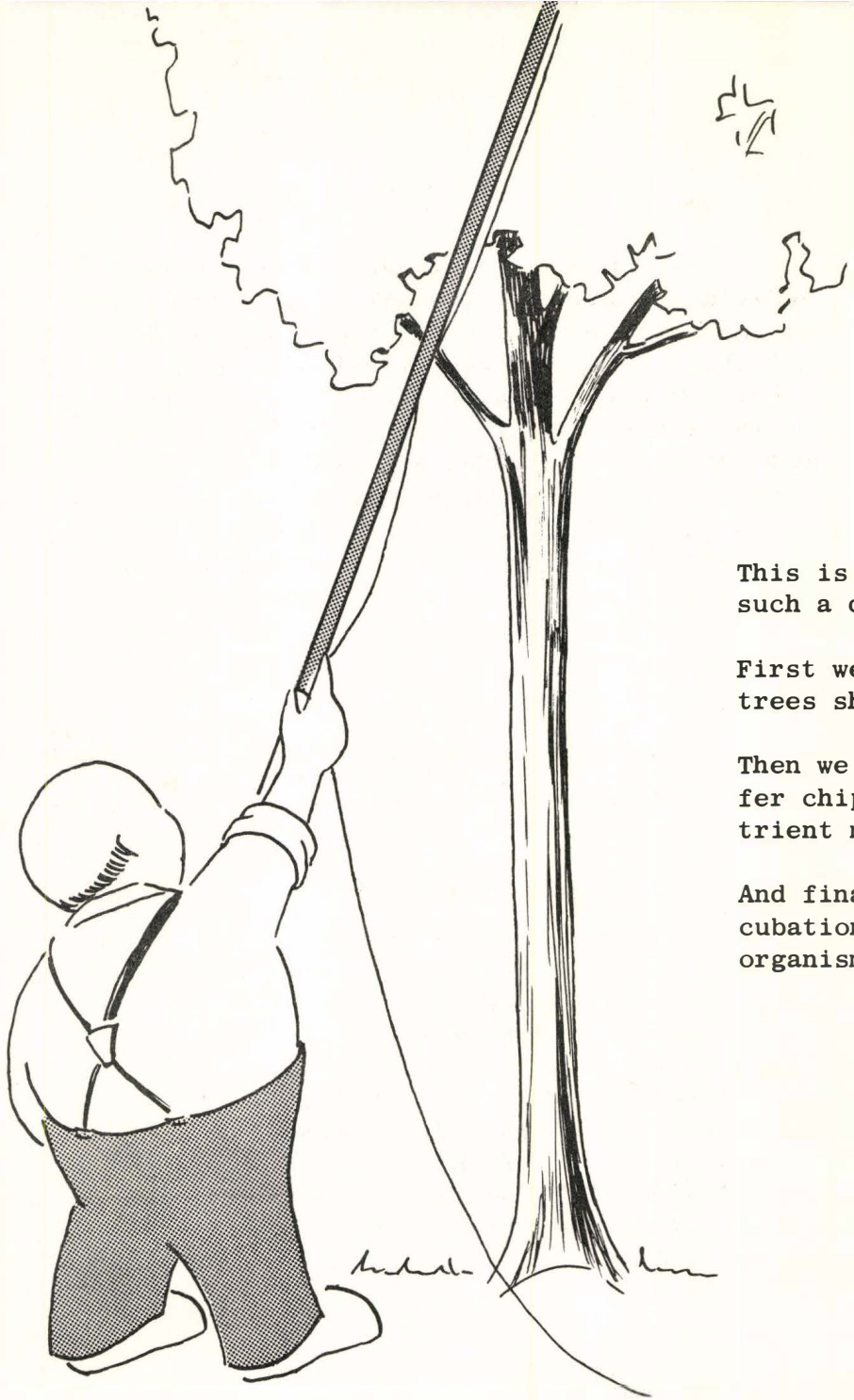


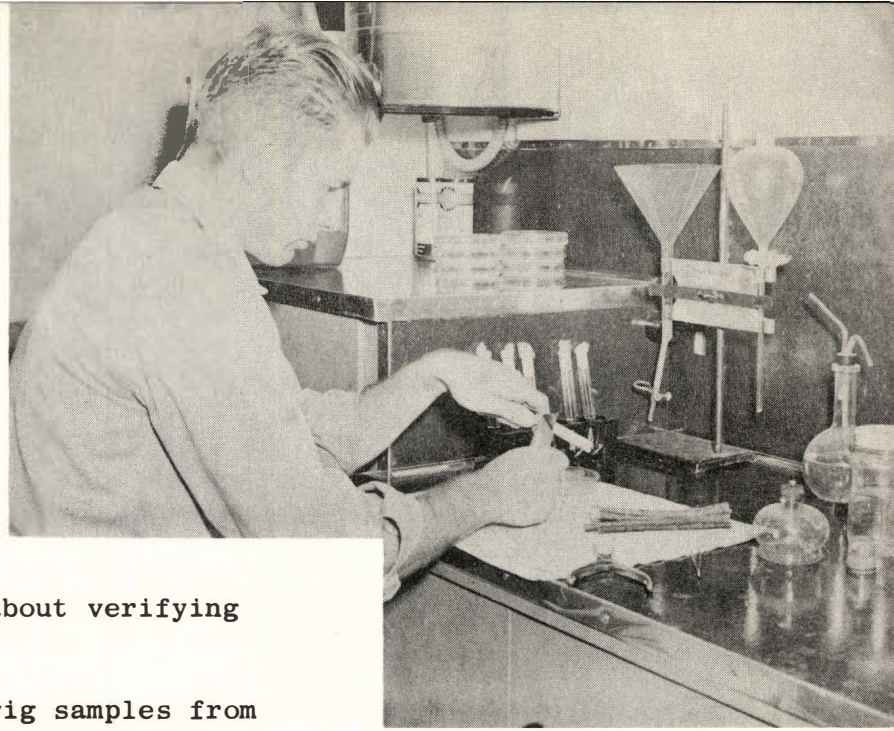
Columbia

Continuing our journey westward we cross the Mississippi River and enter the State of Missouri. Near the center of the State is the headquarters for our Columbia Forest Research Center, which is maintained in cooperation with the University of Missouri. We have more different kinds of research going on here than at any of our other centers. Research is being done in the fields of forest management, fire, economics, range, watershed management, and forest insects and diseases.

The Station's oak wilt disease research is centered here in Columbia where we have been working closely with other technicians at the University. All phases of the problem are being considered: identification of the disease, control, and development of resistant species, to mention a few.

Because the symptoms of the disease are so similar to those of other causes of mortality, early detection of oak wilt, especially in hot, dry weather, has been difficult. However, now that we understand the symptoms better and have developed improved techniques and media for isolating and growing the fungus, we are able to more accurately diagnose the disease in the field.



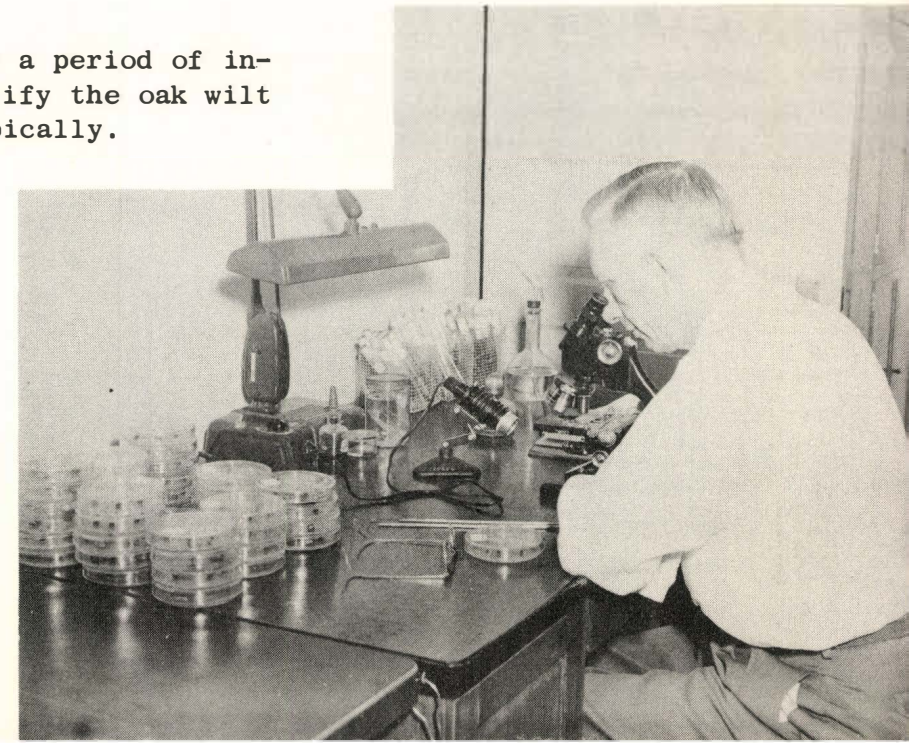


This is how we go about verifying such a diagnosis.

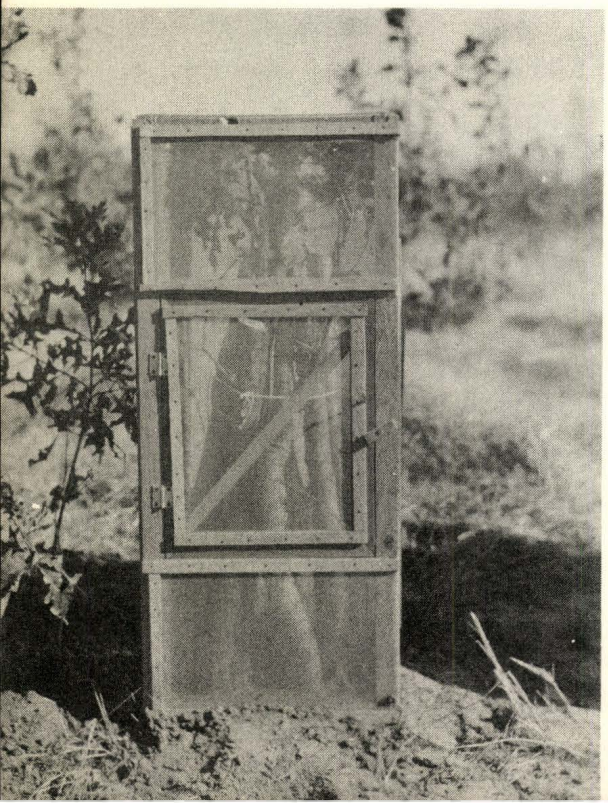
First we collect twig samples from trees showing oak wilt symptoms.

Then we go back to the lab and transfer chips from our samples to a nutrient medium.

And finally, after a period of incubation, we identify the oak wilt organism microscopically.

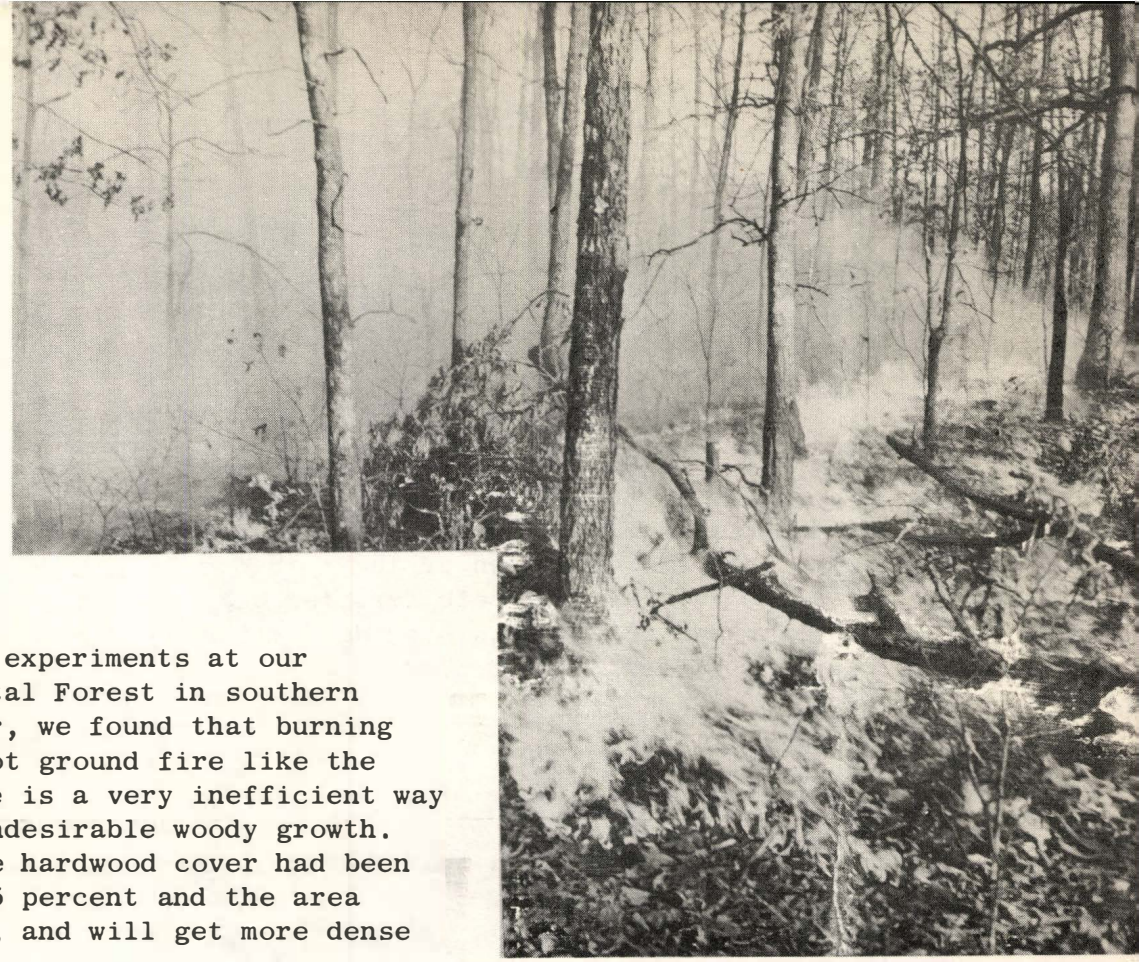


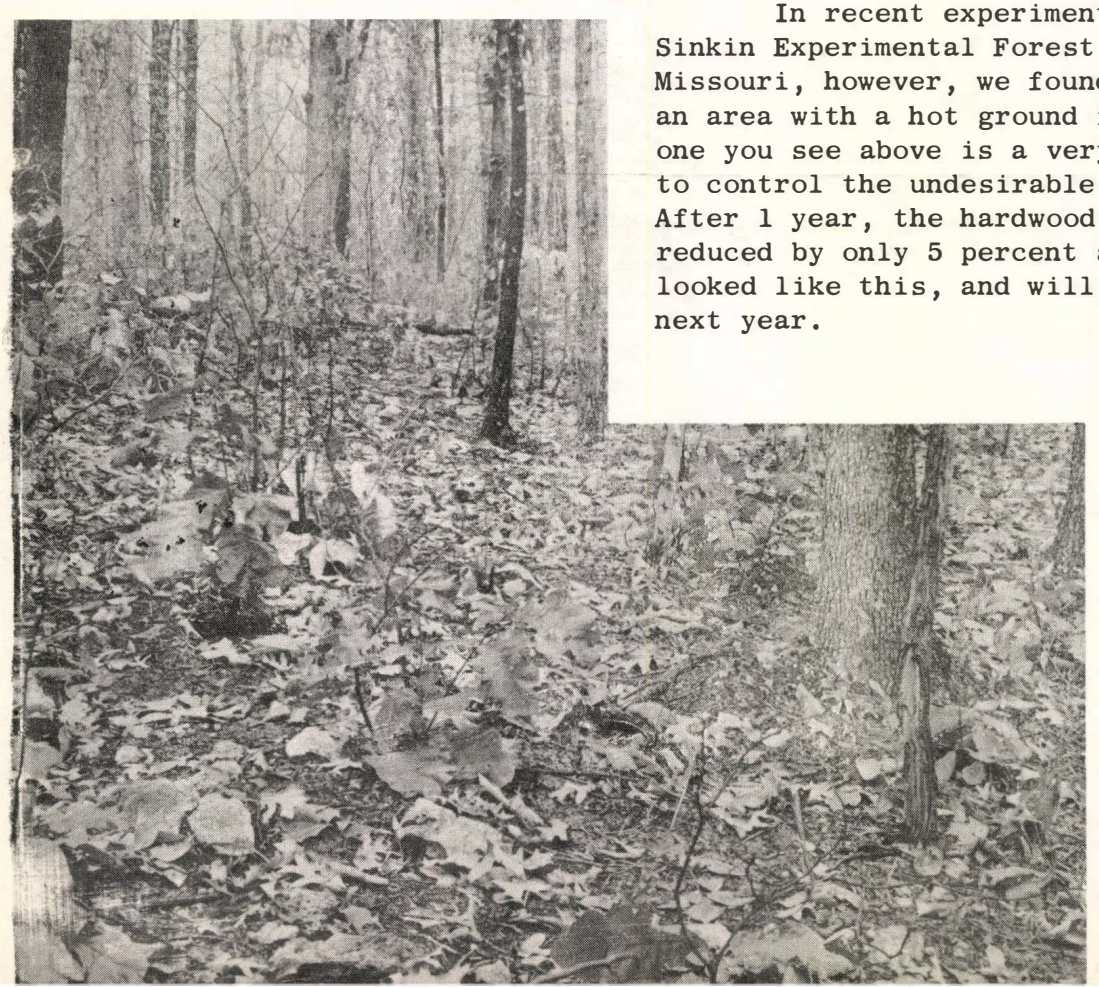
In our search for species of oak or individual oaks that are naturally resistant to oak wilt, we have collected acorns from all over the United States and from many other countries. These acorns are planted in the forest disease nursery near Columbia and the resulting young oak trees are inoculated with the oak wilt fungus. So far, we have tested 51 species of oak and 8 species of other trees in the same botanical family as the oaks. All have proved susceptible to the disease. And so our search still goes on.



In order to find a control for the oak wilt disease itself we must first find out how the disease is carried from tree to tree. It is suspected that the culprit may be an insect, so our forest insect researchers at Columbia have been devoting most of their time to the oak wilt problem too. This work has consisted chiefly of trapping suspected insect species, exposing them to the fungus, and caging them on disease-free oak trees.

Burning forest land in an effort to eliminate brush and tree sprouts in order to improve forage has been common practice in the Missouri Ozarks for years.





In recent experiments at our Sinkin Experimental Forest in southern Missouri, however, we found that burning an area with a hot ground fire like the one you see above is a very inefficient way to control the undesirable woody growth. After 1 year, the hardwood cover had been reduced by only 5 percent and the area looked like this, and will get more dense next year.

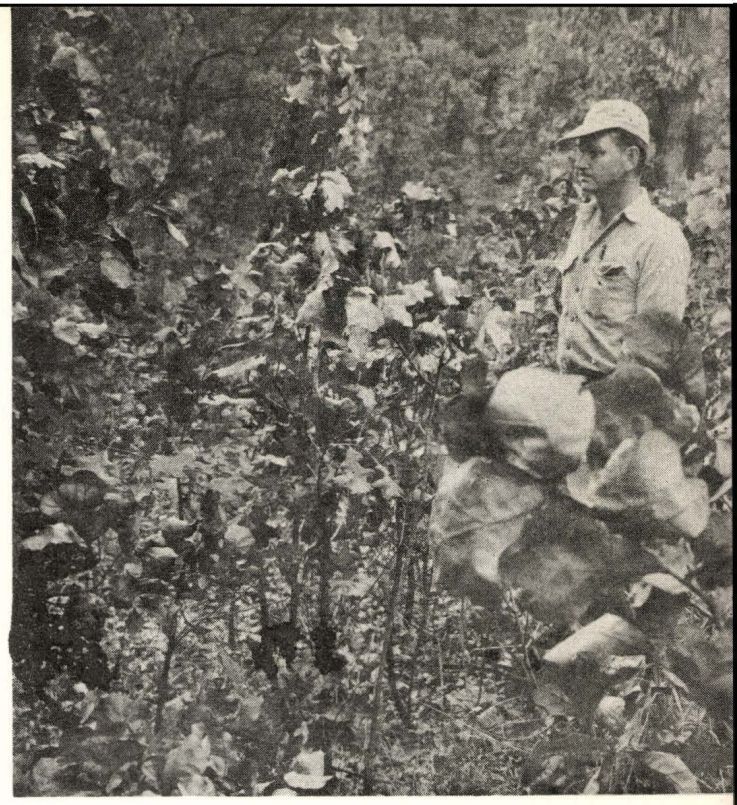
On a similar area that had been treated with a herbicide, the cover was reduced 40 percent the first year and should be reduced by another 30 or 40 percent the second or third year. Production of planted little bluestem grass was 3 pounds per acre on the burned area and 250 pounds per acre where herbicides were used.

Because the production of cattle is an important industry in certain parts of the Missouri Ozarks, we have been carrying on experimental work along this line for some time. We have been trying to reconcile the interests of both forester and cattle producer so as to provide for the best and fullest use of every acre of wild land.

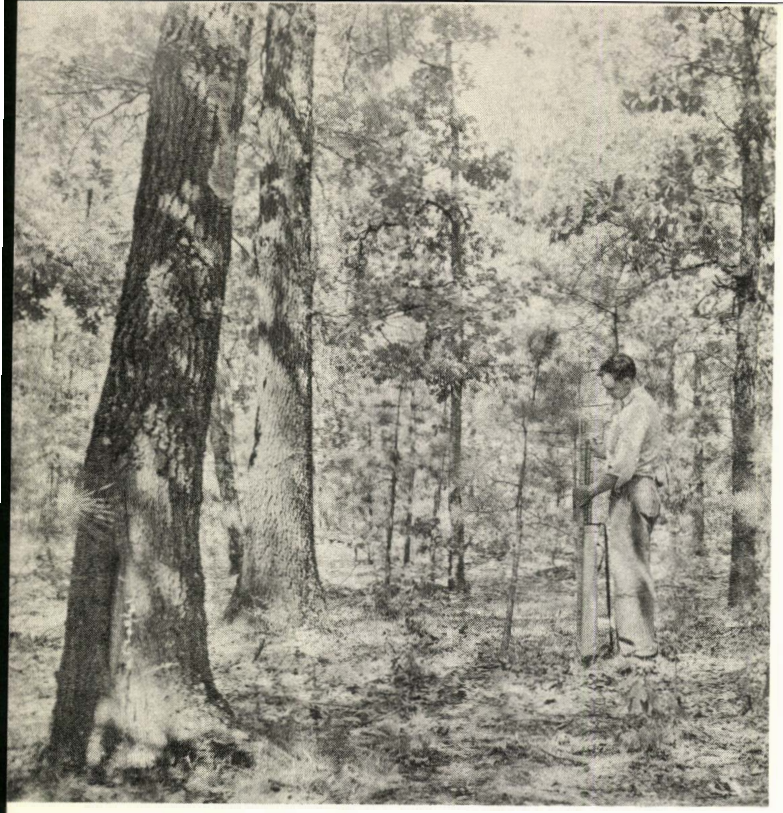
Some of the "forested" land in this area may be more suited for growing forage than trees. One of our important problems is to determine which is more important economically trees or forage. Where the land is more suited for growing forage one of the rangeman's big tasks is to keep the land free from brush and trees. For years it has been common practice throughout the State to attempt to control this undesirable vegetation by burning the range every spring. But fire is a dangerous tool and an inefficient one. So we have been trying in recent years to find ways to do this job cheaply and effectively with herbicides.

Here is a close-up view of a dense sprout thicket which prevents palatable native grasses from developing.

A herbicide applied to the foliage with a hand sprayer kills the tops and most of the roots of the hardwood sprouts within 6 months.



After 2 years the hardwood sprouts are dead and the scattered grass plants have developed into about 1 1/2 tons of palatable forage per acre. The stand of grass you see here is ready for controlled grazing.

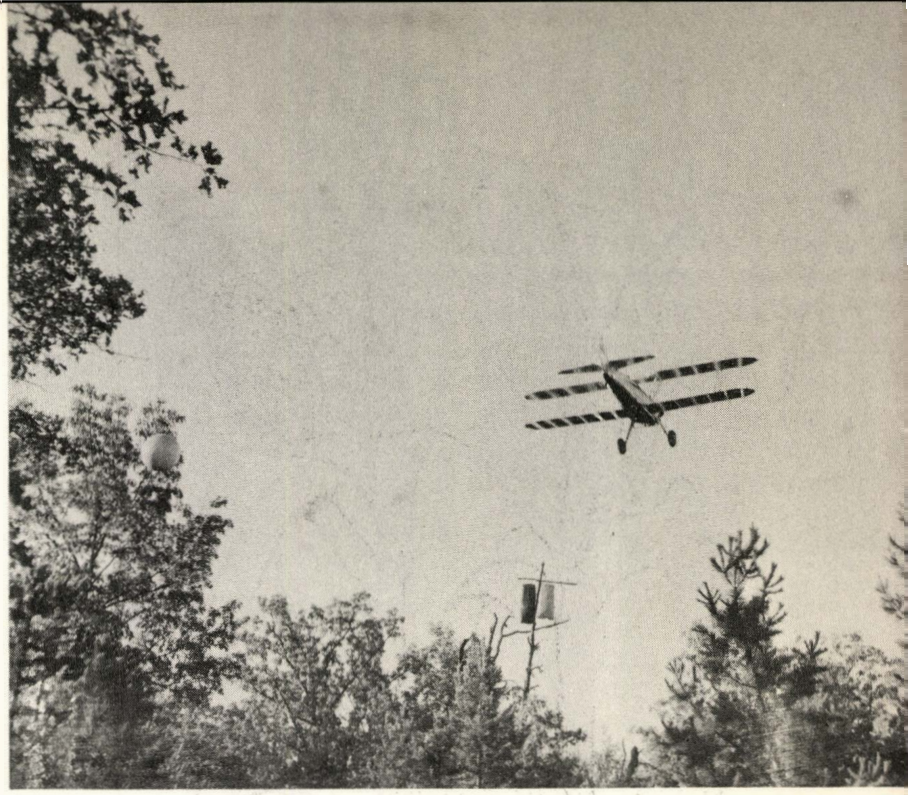


An important forest management problem in this area is converting poor-quality hardwood stands to oak-pine mixtures. Here again we come up against the problem of controlling unwanted hardwoods. We have just completed an extensive study of the effects of overhead release on planted shortleaf pine and advanced hardwood reproduction. Stands of low-quality hardwoods on poor hardwood sites can be converted to pine-oak stands if the planted trees are given proper release. In a stand such as we see here, underplanted shortleaf pine doesn't have much of a chance.

However, if all those old poor-quality hardwood trees were removed, as was done in this stand, the planted shortleaf pine soon outgrows the advanced hardwood reproduction and takes a prominent place in the new stand.

Of course the big problem is to find ways to remove the old hardwood trees economically because most of them contain no merchantable products. Here again we have been experimenting with the use of herbicides. In fact, that airplane you see overhead skirting the tops of the trees is applying a foliage spray to an oak-pine stand similar to the one we are in now.

(Photo courtesy The Salem Post, Salem, Mo.)



Let's look at a stand that was given this treatment about a year ago. Most of the hardwood trees have died. The short-leaf pine trees were not injured by the herbicide and are already responding to the decreasing competition brought about by killing the hardwoods.

Ames

From Columbia we turn north, cross over into Iowa, and come to the last of our full-fledged research centers. The Ames Center is maintained in cooperation with Iowa State College. The area served by this Center is devoted chiefly to the production of corn and cattle. However, the very scarcity of forest land in this farming country makes it important that we find out how best to manage what limited timber resource there is.

Here again regeneration is a problem. Much of our effort has been spent in trying to find ways to encourage hardwoods, especially the oaks, to reporduce themselves. Recent studies at our Amana Experimental Forest (operated in conjunction with the Amana Society) have shown litter and rodents to be deterrents to the early success of oak reproduction. Acorns of white, bur,

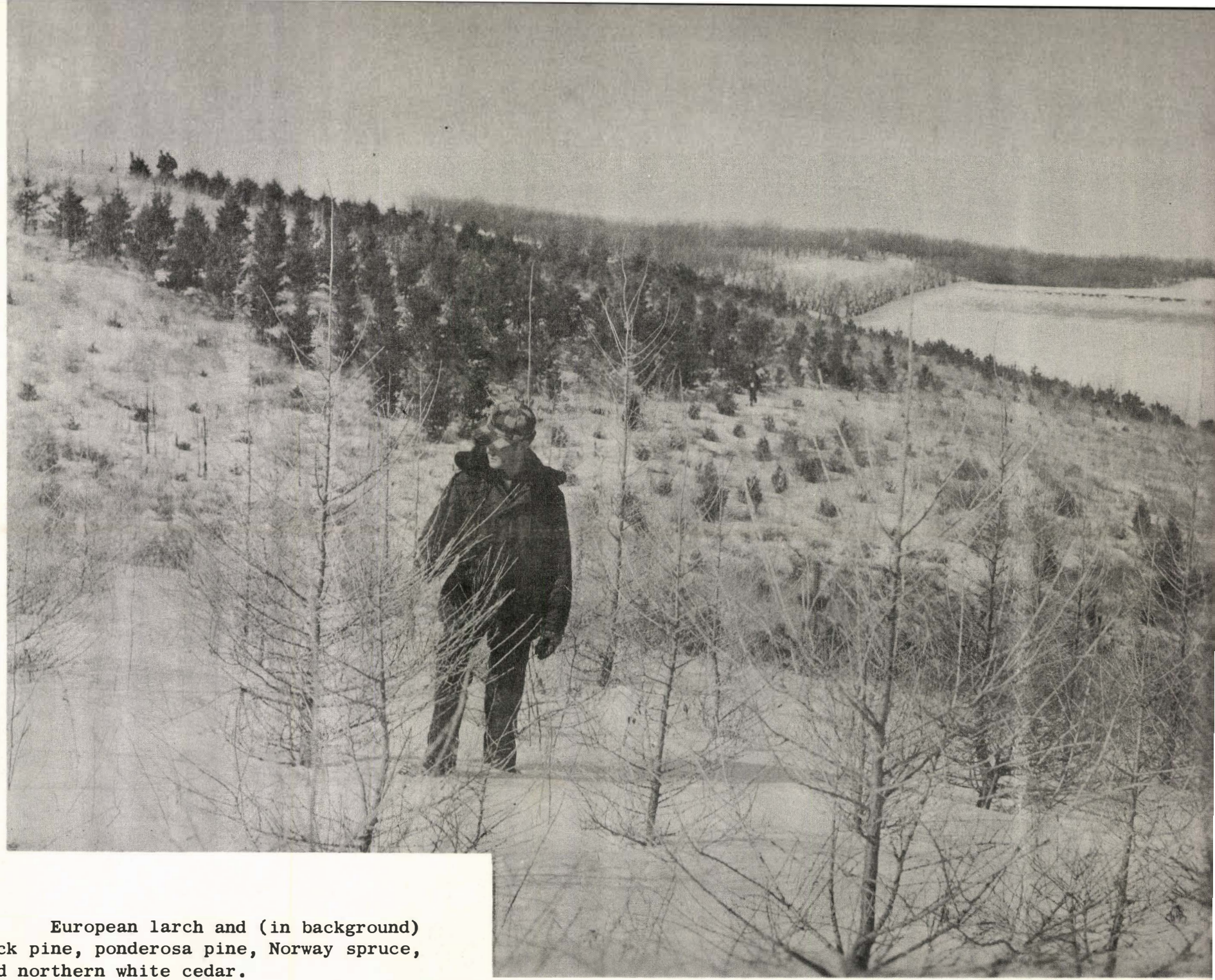
black, and northern red oaks were set out in small plots in an undisturbed upland oak stand. On some of the plots the acorns were placed on top of the existing litter. On others the litter was removed and the acorns were placed on the bare soil. And on still others the acorns were planted in the soil. In each case, some of the plots were protected from rodents and some were not. After 1 year the plots that had had the litter removed and the acorns planted in the soil had the highest germination and survival. Poorest germination and survival occurred on unprotected plots where the acorns had been placed on the surface. Practically all these acorns were taken by squirrels. We believe that planting the acorns in bare ground was more successful because there is less rodent activity on such exposed areas during the winter.

Evidence of rodent activity beneath a layer of litter can be seen by scraping away the litter to reveal the network of tunnels.

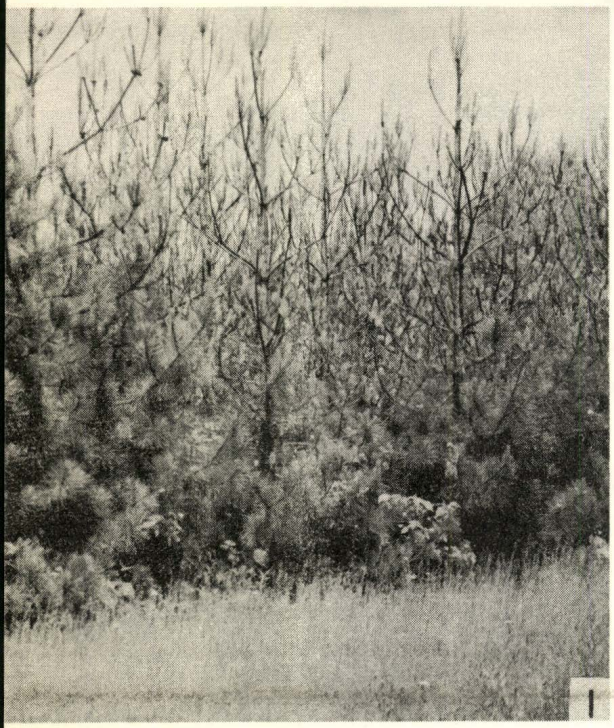
Our next step will be to try such things as disking, controlled burning, and limited livestock grazing in oak stands to see if we can reduce the amount of litter and so create conditions more conducive to oak reproduction.

According to the most recent forest survey of Iowa about 70 percent of the commercial forest land in the State is poorly stocked. Moreover, some of these stands contain so many cull trees or trees of inferior species that the best and quickest way to increase their productivity is to cut all the merchantable timber, kill the remainder by girdling or poisoning, and then plant the entire area. We have begun several such conversion studies in both upland and bottomland forest types. One of the biggest problems encountered has been protecting the planted trees from damage by deer. Apparently the lush growth of low vegetation that develops soon after the stand is open makes the stand an attractive feeding area. One way to postpone development of such low vegetation and so minimize browsing damage is to put off killing the overstory trees until after the planting has been done.

It has been estimated that more than one million acres of land in Iowa are in need of planting. Some of this acreage is in understocked forest stands and some is land currently idle or in some other use but considered more suitable for forest land. As a start toward establishing productive forests on this land we have been testing various species of trees in an effort to find the species most suitable for the different site conditions in Iowa. So far we have tested nearly 30 different species. In western Iowa we have had the most success with eastern redcedar, Rocky Mountain juniper, ponderosa pine, jack pine, Austrian pine, and European larch. Although red pine had good initial survival, this species has suffered much damage from winterkill and drought. The most successful species tried so far in northeastern Iowa included eastern white pine, red pine, jack pine, Austrian pine, ponderosa pine, and white spruce.



European larch and (in background) jack pine, ponderosa pine, Norway spruce, and northern white cedar.

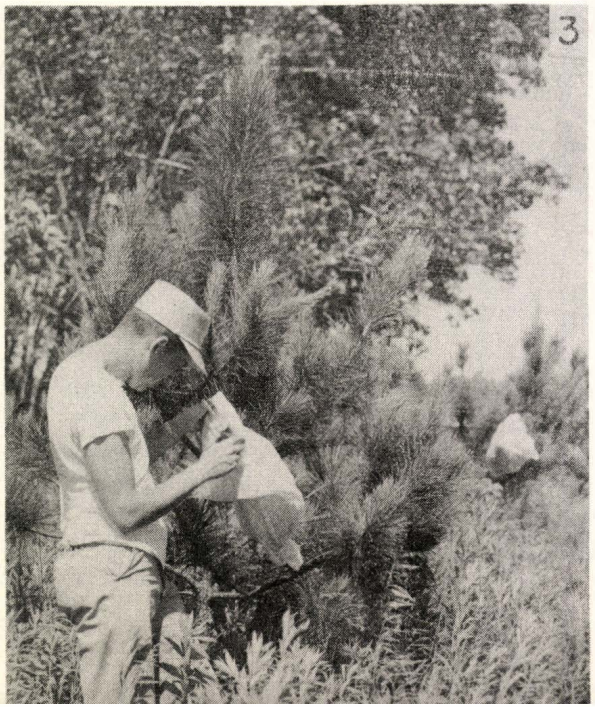


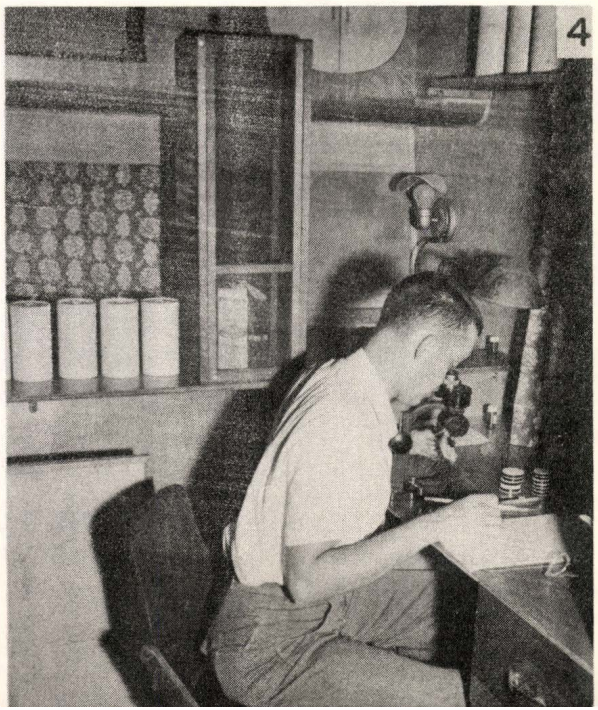
Forest Insect Lab

We've just about made the rounds now, and it's nearly time to report back to headquarters. But let's stop at the edge of Columbus first and visit our forest insect laboratory.

One of man's greatest competitors for trees and timber is the insect. When the insect gets there first -- as he too often does -- he can render a lot of wood (and potential wood) worthless in a very short time. So our forest entomologists are kept busy keeping tabs on insect activity, and developing methods for control.

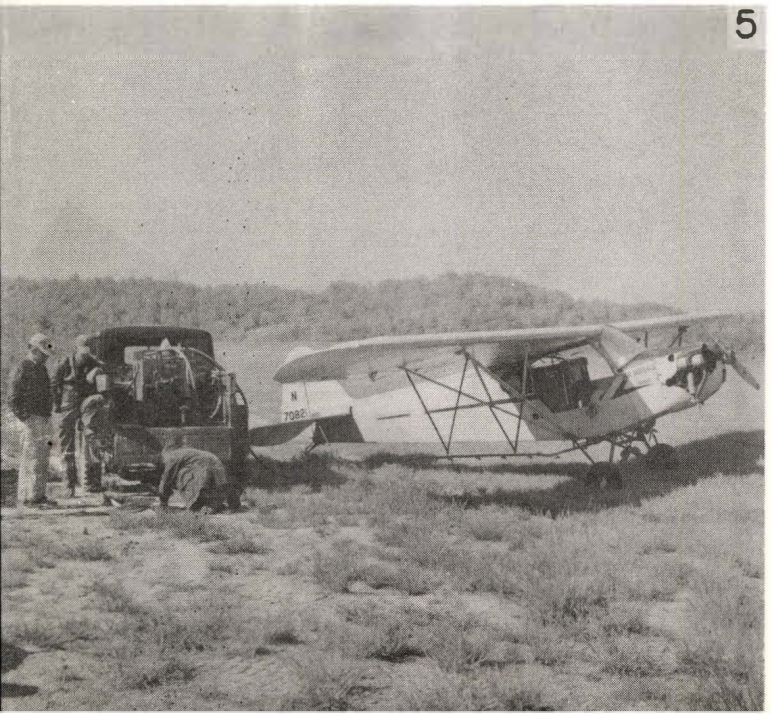
Instead of going into the details of any specific study, we thought you might like to see some of the steps involved in suppressing an insect outbreak from the researcher's point of view.





First comes the task of detecting and reporting serious insect outbreaks. We are trying to enlist the cooperation of all foresters and field workers in allied fields to keep on the alert for damage such as this sawfly defoliation of a pine plantation (1). Because each insect species has a different life history, positive identification of the insect is necessary before we can begin to develop a control. So we take our laboratory along with us and set up shop in the field (2). Then we capture a few specimens red handed (3) and take them into our mobile lab for careful study (4).

When we're satisfied that we know exactly what insect we're dealing with and how to cope with it, we're ready to recommend to some cooperating agency a control program. The "brew" is mixed under the watchful eyes of our entomologists, transferred to a specially equipped sprayer plane (5) -- and away she goes (6)!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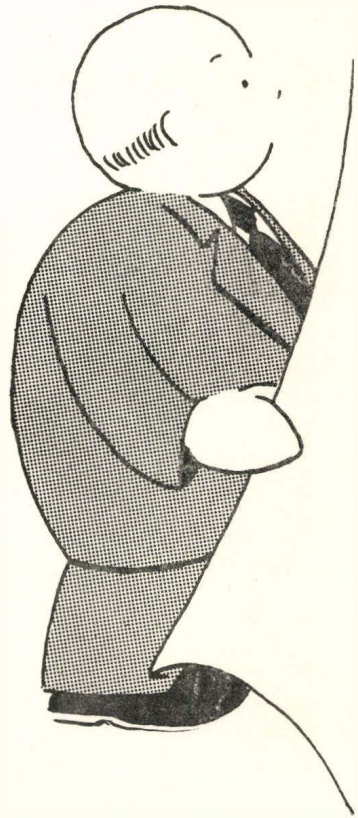
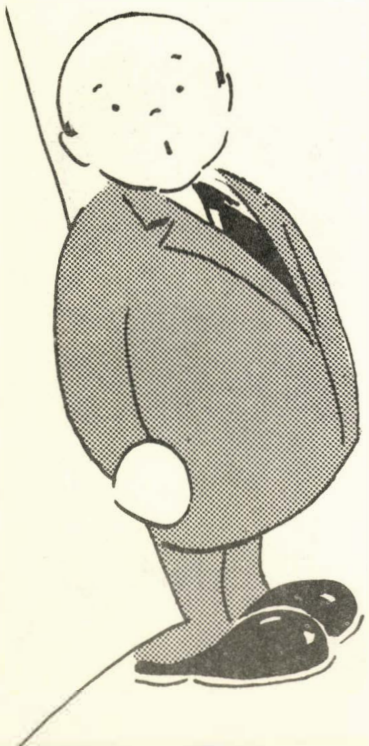
6

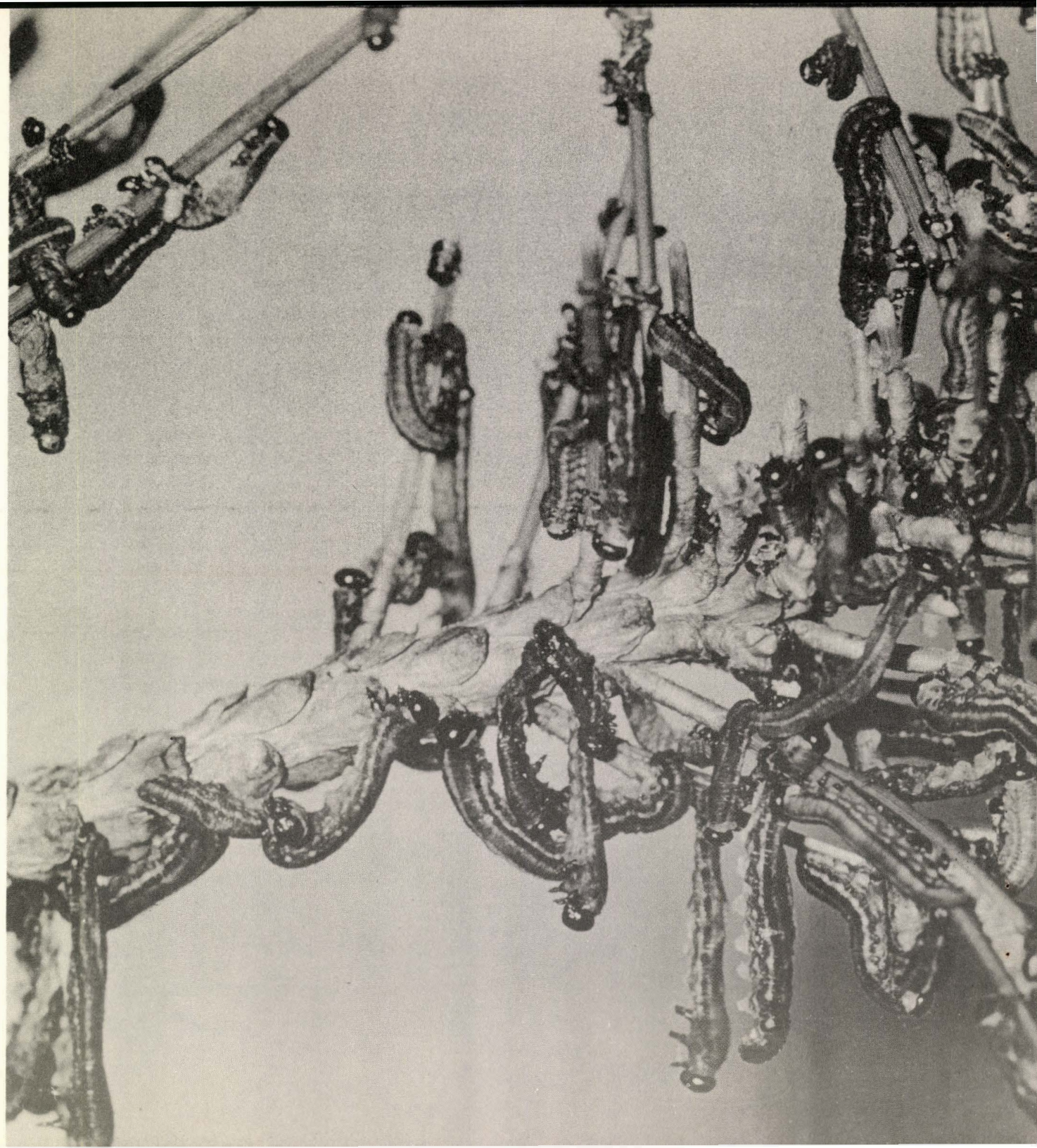
Results ?



LOTS OF 'EM !

(All these sawfly larvae are dead or dying.)





Columbus

Our headquarters office is in Columbus, Ohio. The technical experts who head up our six research divisions are stationed here. Most of these divisions are represented at one or more of the research centers that we have already visited. In addition, we recently opened a branch office in Bedford, Indiana, from which forest management studies in that area will be conducted. Much of our work there will have to do with plantation management experiments on the Wayne-Hoosier National Forest.

Some of the work is carried on directly from the Columbus office, especially in the fields of economics and forest utilization.

Take the Forest Survey for example. This work has been carried on through the Division of Forest Economics. We published the final report for the State of Ohio this past year and the statistical report for Iowa. A final report for Iowa is now being prepared. This will complete our work on the initial survey. We are now making plans to resurvey Missouri.

Other work in the Division of Forest Economics stemming directly from Columbus is concerned chiefly with marketing studies. This year we completed an experimental timber market survey in Ohio in cooperation with the Ohio Division of Forestry. A directory of buyers is being prepared which will list more than 700 buyers.

A new program of marketing research was begun in August at New Philadelphia, Ohio in cooperation with the Muskingum Watershed Conservancy District. We have placed a staff member at the headquarters of the Conservancy District to carry out timber marketing and related economics research studies on the timber operations conducted on their land.

We are also conducting a study with the Ohio Agricultural Experiment Station on the marketing of locally grown Christmas trees. Christmas tree farms like this one are providing more and more trees for local markets every year.

One of the first studies to be undertaken here will be to explore the additional costs and profits involved in selling air-dried lumber in contrast to selling green lumber. At present most small- and medium-sized sawmills in the Central States sell their lumber green, fresh from the headsaw. Although many of these mill operators have access to well-established hardwood grade-lumber markets, some of them are not aware of the differences in price among the various grades of green and air-dried material. Other operators are aware of the price differences, but are reluctant to undertake air drying because they are not familiar with the processes, hazards, and economics involved. We hope to find ways to help overcome these obstacles.

We have also begun studies related to the soil-bank program provided for in the Agricultural Act of 1956. Investigations will be made to show the costs of plantation establishment, costs and possible returns from thinning operations, expected growth and yields for various sites and species, and costs of harvesting and marketing. In the Missouri Ozarks, investigations will be coordinated with work now being done by the Agricultural Research Service. The objective will be to determine the optimum use of available resources (including land) to increase local family incomes. Alternative land uses will be compared.

During the past year the Station has moved toward the establishment of a Division of Forest Utilization Research which will not only absorb the service and troubleshooting activities of the present Forest Utilization Service, but will supervise the expanding research activities in this field. Practically all forest utilization research by the Station is currently concentrated at the Wood Products Pilot Plant operated in cooperation with Southern Illinois University and the Kaskaskia Experimental Forest at our Carbondale Forest Research Center which we visited earlier.

The pulp and paper industry appears to be considering a major expansion in the Central States region. One of the principal activities of the FUS unit during the past year has been to keep abreast of activities in this field. FUS and the Division of Forest Economics have jointly handled a great amount of correspondence and office consultation concerning timber resources, possible plant locations, processing techniques, and other technical problems. Although no completely new pulp and paper plants have resulted as yet, at least three box companies have converted from straw to wood pulp. There also appears to be interest in expanding the roofing felt industry into states other than Illinois, where it has been centered during the last 10 years.

Probably the greatest concern of the forest products industries in this region during the last few years has been finding ways to recover profits from hitherto unused woods residues, including thinnings, stand improvement cuttings, and low-value species as well as sawmill slabs, edgings, and sawdust. Greatest progress has been in the pulp and paper industries. Metallurgical chips also provide an increasing market for such residues. Chip core and other resin-bonded particle boards appear about ready for a greatly expanded production for the furniture trade in the Central States. Charcoal production, particularly in Missouri and Kentucky, has more than doubled in the last few years.

Whew !

Fast trip, eh? Hope you're not tired out. We didn't have time of course to cover all our work in detail, but maybe this bird's-eye view will give you a general idea of what we're trying to do.

If you would like more information about a specific subject, I suggest that you look over our list of 1956 publications that follows. We would be happy to send you any that you are interested in but may not have seen. Those marked with an asterisk (*) are still available.

1956 Publications

* Buchanan, William D.
Preliminary tests indicate that the small oak barkbeetle may be a vector of the oak wilt fungus. Plant Dis. Rptr. 40(6): 654.
(The oak wilt disease developed in 6 of 74 trees that were inoculated with water containing several thousand macerated barkbeetles (Pseudopityophthorous minutissimus) that had emerged from sections of disease-killed trees.)

* Central States Forest Experiment Station
Iowa forest statistics. Forest Survey Release 20, 58 pp., illus.
(Forest area and timber volume statistics for the State of Iowa.)

* Clark, F. Bryan
Growth of shortleaf pine after thinning. Sta. Note 93, 2 pp., illus.
(Basal area growth for a 5-year period following thinning was found to be nearly the same in young shortleaf pine stands thinned to different densities. Unthinned stands have maintained about the same growth rate as thinned stands.)

* Deitschman, Glenn H.
Growth of underplanted hardwoods in black locust and shortleaf pine plantations. Sta. Note 94, 2 pp.
(After 8 years several species of hardwoods planted under black locust were 2 to 3 times taller than when planted under shortleaf pine. In the last few drought years, 38 percent of the yellow-poplar trees under black locust have suffered sunscald and dieback. This did not occur under the pine.)

* ----------
Plotless timber cruising tested in upland hardwoods. Jour. Forestry 54(12): 844-845.
(Basal area and volume estimates by the plotless method in uneven-aged hardwoods were found subject to serious error. Certain limitations to use of the method are pointed out.)

Englerth, George H., Boyce, John S., Jr., and Roth, Elmer R.
Oak wilt fungus can be killed by steaming or kiln-drying. South. Lumberman 192(2400): 46, illus.
(Steaming or kiln-drying killed the oak wilt fungus in 1-inch boards processed from infected oak trees. No fungus isolations were obtained when the moisture content of the boards was less than 20 percent. In air-seasoned and bulk-piled boards, the fungus was viable for 22 weeks and 24 weeks, respectively.)

* ----------, Boyce, John S., Jr., and Roth, Elmer R.
Longevity of the oak wilt fungus in red oak lumber. Forest Sci. 2(1): 2-6.
(Same annotation as above.)

* Greth, John W.
A case study of cull trees on the Kaskaskia Experimental Forest. Sta. Note 99, 2 pp.
(Twenty percent of all trees 4.6 inches d.b.h. and larger on 533 acres of previously unmanaged woodlands were cull. Hickory and a group of miscellaneous species including blackgum, beech, elm, maple, and sassafras had by far the highest proportion of culls.)

* Hartong, A. L. and Moessner, K. E.
Wooded strips in Iowa. Forest Survey Release 21, 15 pp., illus.
(Describes the extent and condition of timber in Iowa growing in fence rows and narrow strips planted or saved from natural stands to serve as windbreaks and shelter.)

* Hay, C. John and Wootten, John F.
Insect damage in hardwood saw-logs. South. Lumberman 192(2399): 59, 62.
(Reprint of Tech. Paper 148, "Insect damage in hardwood sawlogs")
(A survey conducted at sawmill sites throughout eastern Kentucky shows the seriousness of lumber degrade caused by insects which enter and damage the sapwood and heartwood of living hardwood sawtimber.)

* Jensen, Chester E. and Woerheide, John D.
Pin oak form class. Sta. Note 97, 2 pp.
(Gives the form class of pin oak by 2-inch diameter classes from 6 to 22 inches d.b.h. Three areas are covered: (1) the Mingo Swamp area in southeastern Missouri, (2) Mississippi Bottomlands in southwestern Illinois, and (3) the claypan pin oak plots in southern Illinois.)

* Krajicek, John E.
Rodents influence red oak regeneration. Sho-Me Live Wire 7(5): 12.
(Reprint of Sta. Note 91, "Rodents influence red oak regeneration")
(A study in Iowa revealed that reproduction of oaks may be hindered by rodents. No matter whether acorns were placed on top of the litter, beneath the litter or buried in the ground, rodents -- probably mice -- destroyed a high percentage before germination.)

* Limstrom, Gustaf A. and Finn, Raymond F.
Seed source and nursery effects on yellow-poplar plantations. Jour. Forestry 54(12): 828-831, illus.
(There is an inverse relationship between stem diameter and the number of seedlings per unit area. Moreover, relative differences in the height of the seedlings are apparently due chiefly to differences in seed quality.)

* Martin, S. Clark and Crosby, John S.
Burning and grazing on glade range in Missouri. Sho-Me Live Wire 7(4): 6, 7(5): 5. (Reprint of Tech. Paper 147, "Burning and grazing on glade range in Missouri")
(Although controlled burning will help in controlling redcedar on the "glade" range, it cannot be recommended as a general practice because of damage to forage and site.)

* Merz, Robert W. and Boyce, Stephen G.
Age of oak "seedlings." Jour. Forestry 54(11): 774-775, illus.
(The age of oak reproduction occurring in upland oak-hickory stands of southeastern Ohio cannot always be estimated by the age of the stem. In a 5-acre plot 74 percent of the sampled reproduction had root systems as much as 31 years older than the stems.)

Minckler, Leon S.
Tree classes in the unmanaged forests of southern Illinois and application to forest management. Ill. Acad. Sci. Trans. 48: 49-54, illus.
(Tree classes were set up and defined as a guide in the rehabilitation cutting of previously unmanaged stands. Quantitative data are presented which suggest the magnitude of the stand rehabilitation job in southern Illinois.)

* Minckler, Leon S. and Hosner, J. F.
How to farm your forest. Misc. Release 11, 68 pp., illus.
(A semi-popular "how-to-do-it" booklet which gives in some detail the steps necessary to place and maintain a woodland under good management. Emphasis is placed on practical, simple, and economical measures which a small woodland owner could use.)

* Plass, William T.
Killing hardwoods with herbicides in southeastern Ohio. Sta. Note 98, 2 pp.
(Compares cost of application and effectiveness of three herbicides tested in southeastern Ohio. One year after treatment the least expensive treatment to apply, 2,4-D on girdles, had a higher percentage of kill than the other two treatments. All species of red oak appeared to be more readily killed than the white oaks, hickories, or yellow-poplar.)

* Roach, Benjamin A.
Logging costs for central hardwoods. South. Lumberman 193(2409): 53-54, illus.
(Logging cost records on the Kaskaskia Experimental Forest over a 3-year period show that total costs of logs bunched at the side of the road was $13.35 per thousand board-feet. This is well below the value of the logs removed in these first improvement cuts.)

Rogers, Nelson F.
Wide variety of experiments in progress here. The Salem Post, March 29, 1956.
(Thirty different studies now in progress on Sinkin Experimental Forest. Fields of research include forest management, forest fires, forest range, woody plant control, oak wilt, and insect vectors of oak wilt.

* Sander, Ivan L.
White pine plantations for timber and seed. Sta. Note 96, 2 pp., illus.
(Preliminary results of trial plantings to introduce eastern white pine into the central part of the Cumberland National Forest.)

* Walters, Russell S.
A soil tube extractor. Sta. Note 95, 2 pp., illus.
(Directions and illustrations are given for modifying an ordinary bumper jack so that it can be used to extract a driven King soil tube from the ground. The advantage of the homemade jack over that customarily supplied with the King tube is its relative lightness.)

* Whitmore, Roy A., Jr. and Jackson, Willard L.
Increase your profit in the woods. Tech. Paper 151, 10 pp., illus.
(Shows how a timber operator's profits can be increased by proper application of log grades when bucking and by more complete utilization of the merchantable stem. Much volume is lost by leaving high stumps, by unnecessary jump-butting, and by leaving merchantable top material in the woods.)

* Whitten, Russell R.
Elm disease sprays: formulas & ingredients. Sta. Note 92, 2 pp.
(Presents spray formulas recommended for control of elm bark beetles. Briefly describes the ingredients used in these formulas.)

Protecting against Dutch elm disease. Misc. Release 10, 14 pp., illus.
(A brief description of the role of elm bark beetles in the spread of Dutch elm disease. Methods are given for preventing Dutch elm disease by controlling bark beetles.)

Protection against Dutch elm disease. Trees Mag. 16(2): 6, 19, 22, illus.
(Same annotation as above.)

Whitten, Russell R.
Revised spray recommendations for control of elm bark beetles. Arborist's News 21(2): 9-12.
(Same annotation as above.)

Transmission of the disease. Mist Spraying and Dutch Elm Disease Control, pp. 3-8.
(Same annotation as above.)

Spraying for Dutch elm disease control. Essentials of Dutch Elm Disease Control, Proc. Conference on the Control of Dutch Elm Disease, Nov. 13, 1956, Ill. State Chamber of Commerce, pp. 20-25.
(Same annotation as above.)

Wollerman, Edward H.
Strains of black locust resistant to borer. Third Northeast. Forest Tree Impr. Conf. Proc. 1955: 35-38.
(A group of black locust trees at Bryantsburg, Indiana shows unusual freedom from attack by the locust borer. Test plantings of trees propagated from this source and others show that borer-resistance is a property that can be isolated in selected strains of black locust.)

Dutch elm disease. Abstract of Tree Protection Short Course, Univ. of Minn. Inst. Agr. 34-37.
(Dutch elm disease continues to spread westward from the eastern states and is a threat to elms wherever they grow. The native elm bark beetle can carry the disease but the smaller European elm bark beetle, being more prolific and aggressive, is responsible for most infected elms. A combination of spraying and sanitation is the best procedure for protection. There is no cure.)

PUBLICATIONS ISSUED IN 1955 BUT NOT REPORTED IN THE 1955 ANNUAL REPORT

Limstrom, G. A.

Current forest tree improvement research in the Central States. Lake States Misc. Rpt. 40, pp. 37-41.
(Most of the current research in forest tree improvement in the Central States is related to provenance effects for species generally used in forestation programs. These include shortleaf, jack, loblolly, and white pines, eastern redcedar, hybrid poplar, yellow-poplar, and sugar maple. Additional tests of insect or disease resistance of various selections of black locust, elm, and chestnut are under way.)

Minckler, Leon S.

Observations on open-grown, non-native conifers in southern Illinois. Amer. Midland Nat. 54: 460-465, illus.
(Normal height growth of non-native, open-grown conifers occurred up to ages of about 25-30 years. After that height growth fell off rapidly in comparison to native hardwood species or the same species in its native range. Trees reached diameters as large as 20-24 inches in about 80 years.)

* Wollerman, E. H. and Putnam, L. S.

Daphnids help to screen systemics. Jour. Econ. Ent. 48(6): 759-760, illus.
(The sensitivity toward chemicals of a small aquatic animal is put to use by observing its reaction to leaf extracts taken from trees treated with systemic insecticides.)

* ----------, Reese, C. R., and Kiefer, A. S.

Control of black locust insects by systemics. Jour. Econ. Ent. 48(6): 760-761.
(Insects that injure plants by sucking leaf juices were killed with chemicals applied to the soil beneath the tree. Stem borers were not killed.)